FINAL REPORT

EVALUATION OF THE INTEGRATED AMT/AMT-T CURRICULUM

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1. INTRODUCTION

The report is divided into four major sections. The Background outlines the need for pursuing this research to implement and evaluate portions of the integrated Aviation Maintenance Technician Transport (AMT-T) curriculum while the second section describes the revised curriculum development effort and the third develops the methodology and assessment tools used in conducting the evaluation. Finally, the conclusion outlines the implications of this study for the evaluation of the use of advanced technology in implementing the curriculum and enhancing the learning experience. This project is managed by the Aircraft Maintenance Technician Program at Greenville Technical College and conducted in collaboration with the Department of Industrial Engineering at Clemson University (CU). Other partners actively involved in this research include Lockheed Martin Aircraft Center (LMAC) and Stevens Aviation. Moreover, the research also directly supports undergraduate and graduate students.

The findings of this research were disseminated in the following publications:

Arnold, D. and Gramopadhye, A. K., "Preparing the Aircraft Maintenance Technician for Tomorrow: Assessment of the New AMT curriculum," *Proceedings of the HFES/IEA Annual Meeting*, San Diego, August 2000.

Arnold, D, Gramopadhye, A. K., Bingham, J. and Master R., "Evaluation of the Integrated AMT-AMT-T Curriculum: Year 1 Activities," Technical Report, submitted to the Federal Aviation Administration, Biomedical and Behavioral Sciences Division, Washington DC 20591, Human Factors in Aviation Maintenance Research Program, Phase X Progress Report, 2000.

Master, R. Jiang, X., Madhani, K. and Gramopadhye, A. K., "Using the Internet for Instruction to Support Aircraft Maintenance Technology: Development and Assessment," *Proceedings of the International Conference on Computer-Aided Ergonomics and Safety*, August 2001, Maui.

Singh, V., Khasawneh, M. T., Bowling, S. R., Jiang, X., Master, R. and Gramopadhye, A. K., "The Evaluation of Alternate Learning Systems: Asynchronous, Synchronous and Classroom," *Proceedings of the International Conference on Computer-Aided Ergonomics and Safety*, August 2001, Maui.

Arnold, D, Gramopadhye, A. K., and Master R., "Evaluation of the Integrated AMT-AMT-T Curriculum: Year 2 Activities," Technical Report, submitted to the Federal Aviation Administration, Biomedical and Behavioral Sciences Division, Washington DC 20591, Human Factors in Aviation Maintenance Research Program, Phase XI Progress Report, 2001.

2. BACKGROUND

For the Federal Aviation Administration (FAA) to provide the public with continuing safe, secure, efficient and reliable global air transportation, it is important to have undergraduate aircraft maintenance technology programs that encourage careers in the field and address the FAA technology requirements for the future.[3,4,5] This research effort will enable both the establishment of technician performance benchmarks relative to the Part 66 curriculum requirements and the evaluation of the relative merits/consequences of alternative training strategies. These results, then, will form the foundation of a comprehensive AMT/AMT-T training program that will ultimately result in improving the safety and reliability of aircraft maintenance technology and maintenance operations and as a consequence provide the aviation industry with ready access to licensed technicians, a more stable and reliable work force, increased safety performance, improved quality assurance, higher consumer satisfaction, and increased profitability and competitiveness.
Three new Advisory Circulars for aircraft maintenance technology under the FAA Research, Engineering, and Development Authorization Act of 1997, Section Three (Law 105-155) mandate research on future training requirements for projected changes in the regulatory requirements of aircraft maintenance and powerplant licensees. These mandates call for new/updated safety enhancements for AMT/AMT-T training programs and skill requirements for technicians. The introduction of the new Part 66, in particular, imparts future training requirements, both for training levels and objectives, for AMT/AMT-T personnel training procedures. Thus, applied research is needed to develop and implement an alternative methodology for a learner-focused curriculum that is integrated into laboratory experiences via interactive modules of skill mastery and evaluation/assessment. Since the general industry of aircraft maintenance technology requires more rapid training in appropriate skills while also enhancing quality and safety performance, the results of this research will serve as a model for changing training and continuing education certification for aircraft maintenance technology for general and transfer technician application. The alternative learning methodologies can be applied to improving safety standards that govern civil aircraft worthiness and operational performance.

2.1 Research Objectives

The general objective of this research was to develop, implement, and assess the newly integrated curriculum, using alternative training methodologies for technician technology skill transfer and application that demonstrate acceptable student performance through the various levels of the integrated curriculum. Specifically, a detailed assessment of portions of the integrated curriculum was conducted to test whether it meets educational objectives and student performance objectives, that is the desired learning outcomes, and then use these results to further enhance the effectiveness of the curriculum, the learning experience, and the educational delivery system.
Portions of the integrated curriculum included in this project were selected from the units of Ground Operations and Safety, Gas Turbine Engines, and Aircraft Structures. This report outlines the development and evaluation work conducted throughout the project period. As mentioned earlier, this project is managed by the Aircraft Maintenance Technician Program at Greenville Technical College and conducted in collaboration with the Department of Industrial Engineering at Clemson University (CU). Other partners actively involved in this research include Lockheed Martin Aircraft Center (LMAC) and Stevens Aviation. Moreover, the research also directly supports undergraduate and graduate students.

3. CURRICULUM DEVELOPMENT

The primary participants and their respective roles in the research were as follows: GTC AMT served as the test bed for implementing and testing the curriculum. The AMT program is developed the training material, the educational methods and the technology in cooperation with the CU research team. The CU research team was tasked with the development of the assessment methodology and is jointly conducting assessment with instructors from the GTC AMT program along with support from industry partners. The CU team was also actively involved in the development of the educational methods, the training material, and the identification of learning strategies. LMAC and Stevens Aviation have provided industry input on curriculum development and assessment activities. In addition to instructional material, a course related web site was developed to support distance learning. Results of Year 1 and year 2 activities were used to enhance the functionality and the interface design features of the web-site. The classic task analytic instructional design methodology was used to develop curriculum material.[6,7,8,9] In specific, the systems approach model was followed (Figure 3.1). The instructional design methodology focused on three aspects:

1. Content- The curriculum content specifies the instructional material to be covered as part of the instructional units.

2. Methods- The methods specify the learning strategies to be used, including feedback, active, feed forward, drill and practice, progressive parts, and others.

3. Delivery - The delivery system focuses on the way instruction is imparted, for example, classroom based, on-the-job, simulated on-the-job, laboratory-based, or computer based.

As a first step, the faculty developed an expanded statement of the missions and goals for the AMT program (Figure 3.2). Following this step a detailed goals statement identifying the means of assessment and the criteria for success for the three representative courses were developed (Figures 3.3 through 3.5). This was followed by content development. As an initial prototype the Ground Handing and Services Course was selected. Using the Knowledge, Application and Manipulative Skills framework (Figure 3.6) and the student performance objectives (Table 3.1), a detailed course outline was developed. Next, the developers identified the appropriate content, learning strategy and delivery system based on the resources available for each of the nineteen student performance objectives. In creating the content, the developers evaluated the use of the alternate delivery systems listed below:

1. Classroom: Lecture material, overheads, tests, instructional support material, exams, etc. were developed.

2. Lab exercises: Laboratory exercises and hands-on projects were identified and developed.

3. Multimedia: Multimedia-based computer instructional modules that can be integrated to emphasize classroom-based instruction were developed. Examples include streaming video of aircraft towing operations and confined space operations.

In addition to instructional material, course related web-sites were developed to complement existing classroom instructions. It is anticipated that the use of the Internet and multimedia in conjunction with classroom instruction will provide students with better orientation in the use of computers. In the future, this facility can be used to facilitate distance learning programs. A web page was developed for the Ground Operations and Safety Course (Figure 3.7). Using the web site, students can access all information pertaining to the course, use the e-mail facility to contact the course instructor and interact with members on team projects using the chat room facility. The web site has the following specific features **(**Figures 3.8 through 3.12)**:**

1. Course Outline: A detailed outline of the course, including the grading policy, the course content and the schedule is provided.

2. Calendar of Course Events: This utility allows the instructor to mark important dates and milestones using the calendar.

3. Mail: Students can setup their own e-mail accounts for the course.

4. Bulletin Board: This facility allows the instructor to set up on-line discussions on specific topics so that students enrolled in the course can participate.

5. Assignments: Course assignments and out-of-class reading/projects can be assigned by the instructor.

6. Chat: Using this utility, the instructor can set up discussion groups on various topics, facilitating communication between team members.

7. Lectures: Using this utility, the students can access PowerPoint or HTML format of the instructor's lecture notes.

8. Handouts: Instructors can post handouts for in-class and out-of-class readings.

9. Pictures: Using this utility, students can access pictures and videos that support lecture notes.

Following the development of material for the revised Ground Handling and Services Course, appropriate methods of testing were developed/identified (Tables 3.2 through 3.4). These methods were selected so that they could measure the students' knowledge, application, and manipulative skill on each of the nineteen performance objectives (Table 3.5).[1,2,10,11,12,13,14,16,17] In addition to the mapping of performance objectives with the testing methods, a list of the advantages and disadvantages of the various testing methods were also developed (Tables 3.5 and 3.6). The course material along with the testing methods were evaluated by SME (Subject Matter Experts) from the industry. Results from this evaluation were incorporated into the first offering of the course set for the Fall 2000 Semester. In addition to the curriculum development activities, facilities were upgraded and resources were procured to deliver the revised course curriculum. This included the set-up of the smart classroom and the procurement of 24 multi-media workstations with Internet connections.

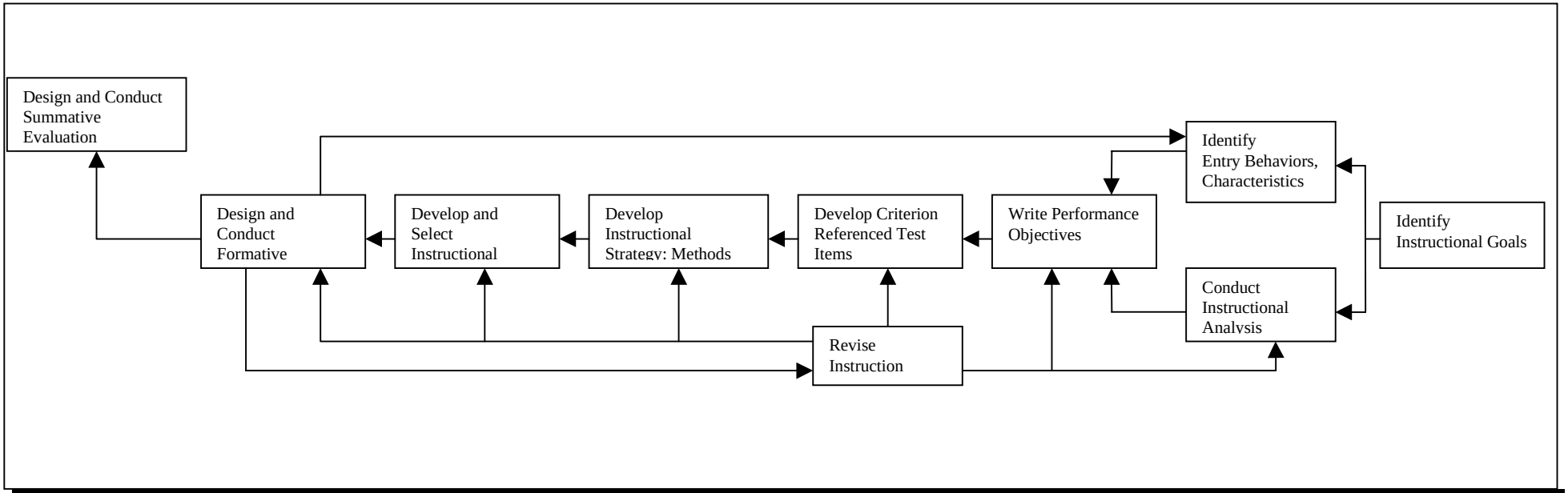

Figure 3.1: A systems approach model for designing instruction

Aviation Maintenance Technology/Greenville Tech College

(Department/School/Administrative Unit)

Doyle Arnold — 1999

(Completed by:) — Academic Year

Expanded Statement of Institutional Purpose (In this section, please provide a statement that demonstrates how your department/unit relates to your college or division's statement of institutional purpose, and through the college/division to the Clemson University's mission and goals.)

Mission:

Provide quality post-secondary programs and services primarily to residents of Greenville County

The faculty of the Department of Aviation Technology has adopted these program objectives and outcomes to guide the conduct and continuous improvement of the Aviation Maintenance program

Goal(s):

Provide credit and non-credit courses and programs to meet both student interests and the assessed employment needs of the service area and to encourage economic and community development.

Community Goals

- Cultivate a partnership with industry which guides and continuously improves the training program
- Produce students whose skills and knowledge are actively sought by industry employers
- Produce students capable of meeting the employment needs of the community

Figure 3.2: Assessment plan (Continued…)

FAA Goals

- Provide a course curriculum designed to meet the objectives and guidance of FAR Part 147

Student Goals

- Provide a State of the Art learning experience for each student based upon their individual needs
- Instill the skills and knowledge necessary for the student to pass the FAA Oral and Practical Examination
- Provide a challenging course curriculum designed to stimulate thought and enhance the learning process
- Provide an atmosphere which encourages student participation
- Provide practical]all exercises designed to build upon classroom presentation and develop student's skills

Figure 3.2: Assessment plan

Department Aircraft Maintenance Technology **Academic Year** 1999

Program Title and Degree (if applicable) ACM 115 Ground Handling and Servicing

Goal: **Provide instructions on engine starting, ground operations, aircraft movement, ground handling and servicing, safety requirements and procedures. Also covered is interpretation and application of aircraft weight and balance procedures as listed in FAR Part 147 Appendix B**

Intended Educational (Student), Research or Service Outcomes, Administrative Objectives or Expected Results (Please duplicate and use this page. It is best to include the objective and continuous numbers on each page.)

Expected Results: Students satisfactorily completing all courses objectives and obtaining a passing grade for the course

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Means of assessment include written tests and exams, practical lab exercises, and instructor observations.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 70% on written tests and exams. Success for practical lab exercises is determined by completing the project in accordance with established industry standards or manufactures specifications.

Instructor's observation factors in as a percentage of the student's overall grade, items evaluated include safety, shop procedures, attitude, and class participation.

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Written tests and quizzes consisting of multiple choice, fill in the blank, matching, and essay type questions are used to assess the knowledge of the students

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 70% on written tests and exams.

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Practical lab exercises for this objective consists of movement of aircraft, connecting/operating ground support equipment, aircraft refueling operating, and weight and balance computations. Each objective is demonstrated by the instructor, then the students are provided an opportunity to complete each practical exercise.

Figure 3.3: Assessment plan: Ground handling and servicing (Continued…)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question “I know that I am successful when…”)

Success is measured by observing the students perform each objective. Each operating must be performed in accordance with industry standards. FAA manuals, or manufactures manual.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Throughout the course the instructor is observing each student’s performance and classroom participation. Student's participation in the classroom and during practical lab exercises is encouraged.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question “I know that I am successful when…”)

Each student is provided an opportunity to practice all Lab Exercises before the evaluation. Success is established when the student completes the practical lab exercise without jeopardizing safety, damage to equipment, and in accordance with the guidance in the appropriate maintenance manual, FAA manual, or manufactures' manual, The students earn a pass or fail rating based on how well they completed the exercise.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question “I know that I am successful when…”)

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question “I know that I am successful when…”)

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Figure 3.3: Assessment plan : Ground handling and servicing

Department Aircraft Maintenance Technology **Academic Year** 1999

Program Title and Degree (if applicable) ACM 224 Turbine Engine Overhaul

Goal: **Provide instructions on the history, theory, construction, and principles of operation of turbine engines, unducted fans, and auxiliary power units. Also included in engine is removal and installations, engine maintenance, testing, adjustments, hot section inspection, and overhaul procedures as listed in FAR Part 147, Appendix D**

Intended Educational (Student), Research or Service Outcomes, Administrative Objectives or Expected Results (Please duplicate and use this page. It is best to include the objective and continuous numbers on each page.)

Expected Results: Students satisfactorily completing all course objectives and obtaining a Passing grade for the course

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Means of assessment include written tests and exams, practical lab exercises, and instructor observations

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 7O% on written tests and exams. Success for practical lab exercises is determined by completing the project in accordance with established industry standards or manufactures specifications.

Instructor's observation factors in as a percentage of the student's overall grade, items evaluated include safety, shop procedures, attitude, and class participation

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Written tests and exams consisting of multiple choice, fill in the blank, matching, and essay type questions are used to assess the knowledge of the students.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 70% on written tests and exams.

_. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Practical lab exercises for this objective includes disassemble, clean, inspect, identify repairs, and reassemble of the cold and hot section of the engine. Engine removal and installation, and inspection and repair of turbine engines. Each objective is demonstrated by the instructor, then the students are provided an opportunity to complete each practical exercise

Figure 3.4: Assessment plan: Turbine engine overhaul (Continued…)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is measured by observing the students perform each objective. Each exercise must be performed in accordance with industry standards, FAA manuals, or manufactures' manuals.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Throughout the course the instructor is observing each student's performance and classroom participation. Student's participation in the classroom and during practical lab exercises is encouraged.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Each student is provided an opportunity to practice all Lab Exercises before the evaluation. Success is established when the student completes the practical lab exercise without jeopardizing safety, damage to equipment, and in accordance with the guidance in the appropriate maintenance manual, FAA manual, or manufactures' manual, The students earn a pass or fail rating based on how well they completed the exercise.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Figure 3.4: Assessment plan: Turbine engine overhaul

Department_ Aircraft Maintenance Technology_____ Academic Year_1999_____

Program Title and Degree (if applicable) ACM 130 Sheet Metal Layout and Repair_____

Goal: Provide instructions on the principles of sheet metal layout, bending, rivet installations, structural inspections, god repair methods for aircraft as listed in FAR Part 147, Appendix C

Intended Educational (Student), Research or Service Outcomes, Administrative Objectives or Expected Results (Please duplicate and use this page. It is best to include the objective and continuous numbers on each page.)

Expected Results: Students satisfactorily completing all course objectives and obtaining a passing grade for the course

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Means of assessment include written tests and exams, practical lab exercises, and instructor observations.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 70% on written tests and exams. Success for practical lab exercises is determined by completing the project in accordance with established industry standards or manufactures specifications.

Instructor's observation factors in as a percentage of the student's overall grade, items evaluated include safety, shop procedures, attitude, and class participation.

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Written tests and exams consisting of multiple choice, fill in the blank, matching, and essay type questions are used to assess the knowledge of the students.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is established based on a minimum passing score of 70% on written tests and exams.

__. Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Practical exercises for this objective include fabrication of u-channel, flushpatch, flange, and a joggle. Identification and installation of rivets, special fasteners for composite structures, and repair of defective rivet holes in aircraft structures.

Figure 3.5: Assessment plan: Sheet metal layout and repair (Continued…)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Success is measured by observing the students perform each objective. Each exercise must be performed in accordance with industry standards, FAA manuals, or manufactures' manuals.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Throughout the course the instructor is observing each student's performance and classroom participation. Student's participation in the classroom and during practical lab exercises is encouraged.

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Each student is provided an opportunity to practice all Lab Exercises before the evaluation. Success is established when the student completes the practical lab exercise without jeopardizing safety, damage to equipment, and in accordance with the guidance in the appropriate maintenance manual, FAA manual, or manufactures' manual, The students earn a pass or fail rating based on how well they completed the exercise.

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Criteria for Success (Establishes the criteria for Program Success on Means of Assessment and answers the question "I know that I am successful when…")

Indicator

Means of Assessment (the procedures, strategies, or means by which you will collect information to validate the outcome objective)

Figure 3.5: Assessment plan: Sheet metal layout and repair

Student Performance Objectives

The student performance objective is a statement of desired learning outcomes in terms of student behavior. In addition, the student performance objective serves as a guide to the selection of strategies and methods of instruction, and provides criteria for evaluation of learning.

The student performance objective number is an alphanumeric system that allows for the tracking of the student performance objective. The sequence of the student performance objective is not an indication of the order of instruction.

Student Performance Levels

Student performance levels provide the minimum standards of acceptable achievement that must be obtained by the student for each student performance objective. Due to the unique nature of each student performance objective the standards of performance required will be different for each student performance objective.

Student performance levels are divided into three elements: knowledge, application and manipulative skills. Each element is further divided into three measures of performance.

Knowledge

Knowledge is the measurement of the students understanding of the principles, practices, and operational concepts of the subject or task. The three levels of performance are:

Level	Description
A	Basic knowledge of general principles or practices
B	Knowledge of general principles, practices and operational concepts
C	High level of knowledge of principles, practices and operational concepts

Application

Application is the measurement of the students' ability to identify and apply rules or principles to solve a problem or complete a task with an element of difficulty. The three levels of performance are:

Level	Description
A	No practical application
B	Limited practical application
C	High degree of practical application

Manipulative Skill

Manipulative Skills is the measurement of the students' ability to perform a task or process with speed, accuracy, and to accepted industry standards. The three levels of performance are:

Level	Description
A	No development of manipulative skills
B	Development of sufficient manipulative skills to perform basic operations
C	Development of manipulative skills required to simulate “return to service”

Figure 3.6: Knowledge, application and manipulative skills framework

Table 3.1: Student performance objectives for ground operations and safety course

SPO Item #	Student Performance Levels			Student Performance Objectives
	Knowledge	Application	Manipulative Skills	
GOS 1	C	C	B	Demonstrate the ability to start, ground operate, tow (including pushback ant gates), taxi, and secure aircraft
GOS 2	B	A	A	Demonstrate the ability to explain the procedures and precautions for fueling and defueling aircraft certified under FAR Part 23, and 25
GOS 3	C	C	A	Demonstrate the ability to select the appropriate MSD sheet for an item and identify the various information and warnings contained on MSDS sheet
GOS 4	C	C	A	Demonstrate the ability to explain the EPA, OSHA, and ICAO procedures for handling hazardous materials on and around aircraft
GOS 5	C	C	A	Demonstrate the ability to identify typical hazards found on aircraft ramp and hanger areas
GOS 6	C	C	A	Demonstrate the ability to explain standard safety practices and procedures for working on and around aircraft located on airport ramps
GOS 7	C	C	A	Demonstrate the ability to locate and explain OSHA standard safety practices and procedures for confined space entry
GOS 8	B	B	A	Demonstrate the ability to locate and explain OSHA Regulations related to aircraft maintenance activities
GOS 9	C	C	A	Demonstrate the ability to explain standard safety practices and procedures for working around jet blast hazard areas

SPO Item #	Student Performance Levels			Student Performance Objectives
	Knowledge	Application	Manipulative Skills	
GOS 10	B	B	B	Demonstrate the ability to perform aircraft interior, exterior and powerplant cleaning
GOS 11	B	A	A	Demonstrate the ability to explain the general properties and purposes of aircraft fuels, lubricants and greases
GOS 12	C	C	B	Demonstrate the ability to identify and select aircraft fuels
GOS 13	C	C	B	Demonstrate the ability to identify and select powerplant lubricants
GOS 14	C	C	B	Demonstrate the ability to identify and select hydraulic fluids
GOS 15	C	C	B	Demonstrate the ability to identify and select aircraft lubricants and greases
GOS 16	C	C	B	Demonstrate the ability to identify and select propeller lubricants
GOS 17	B	A	A	Demonstrate the ability to explain the procedures and precautions for deicing aircraft operating under FAR Part 121 and 135
GOS 18	C	C	C	Demonstrate the ability to use proper hand signals for taxiing and ground movement of aircraft
GOS 19	C	C	C	Demonstrate the ability to use proper voice procedures for aircraft radio transmissions

Figure 3.7: Screen showing the welcome page to the web site and icons leading to the various course sites

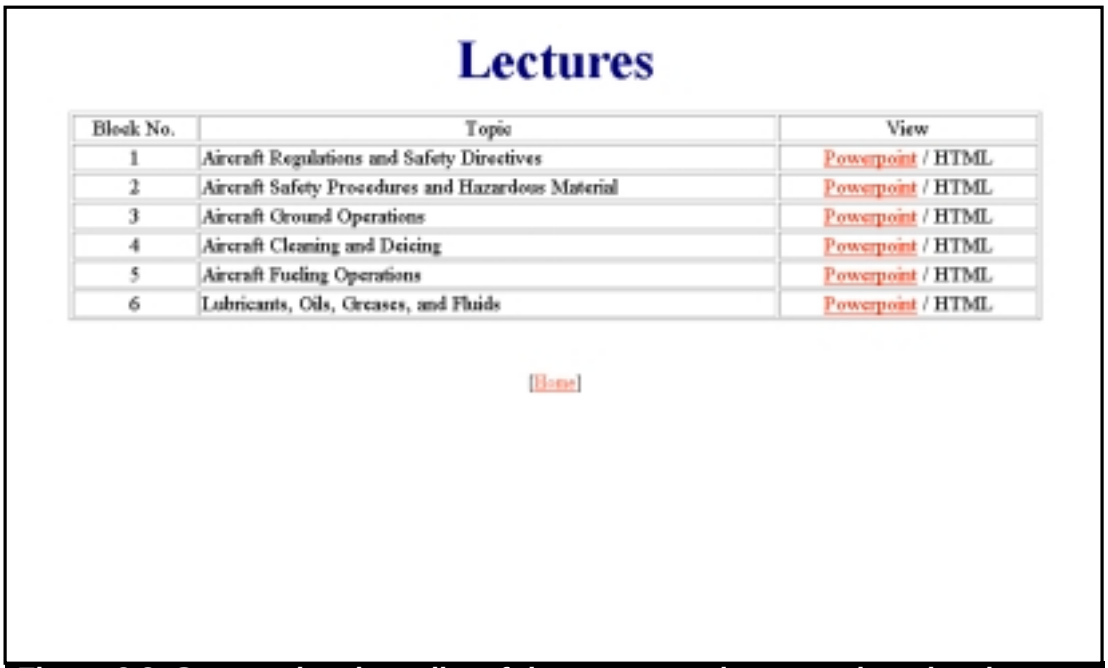

Figure 3.8: Screen showing a list of the course topics posted on the site

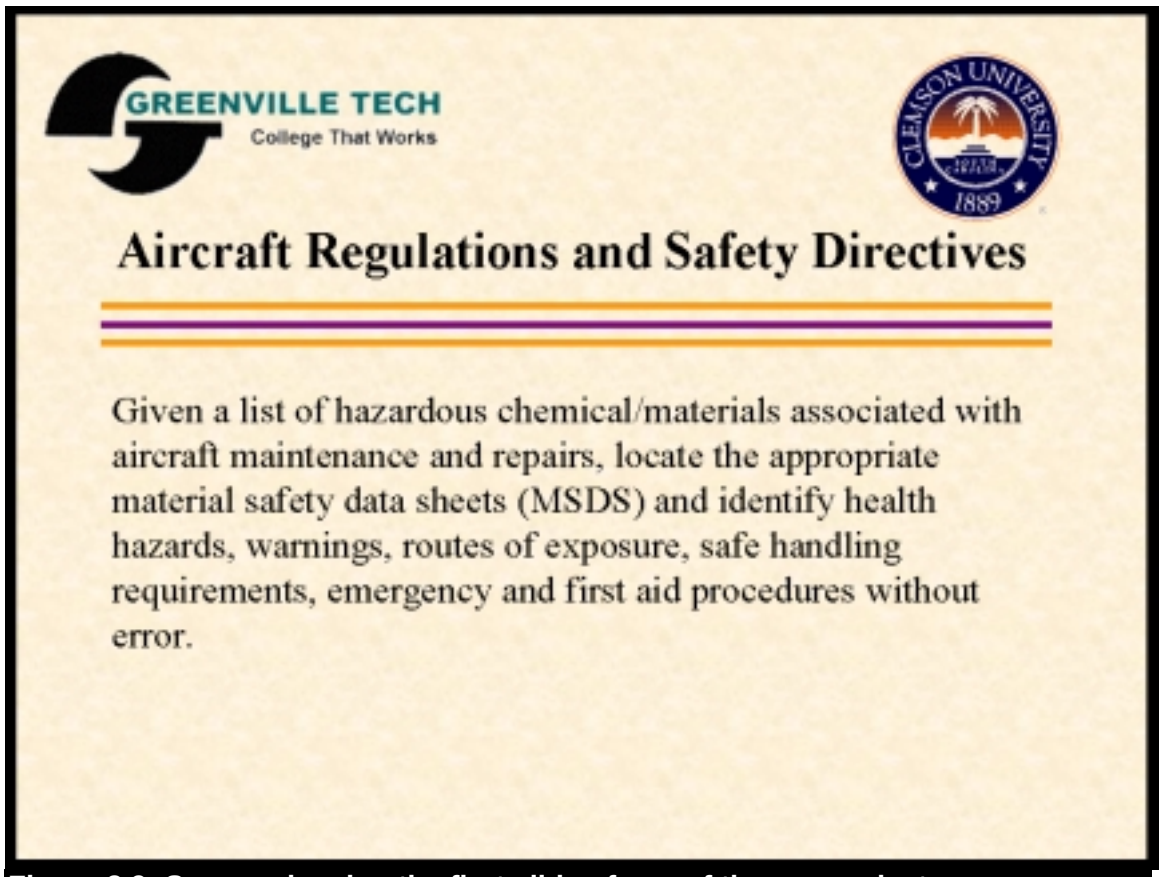

Figure 3.9: Screen showing the first slide of one of the course lectures

Figure 3.10: Screen showing links to pictures of aircraft maintenance facilities

Figure 3.11: Screen Showing a Sample Picture of an Aircraft Maintenance Facility

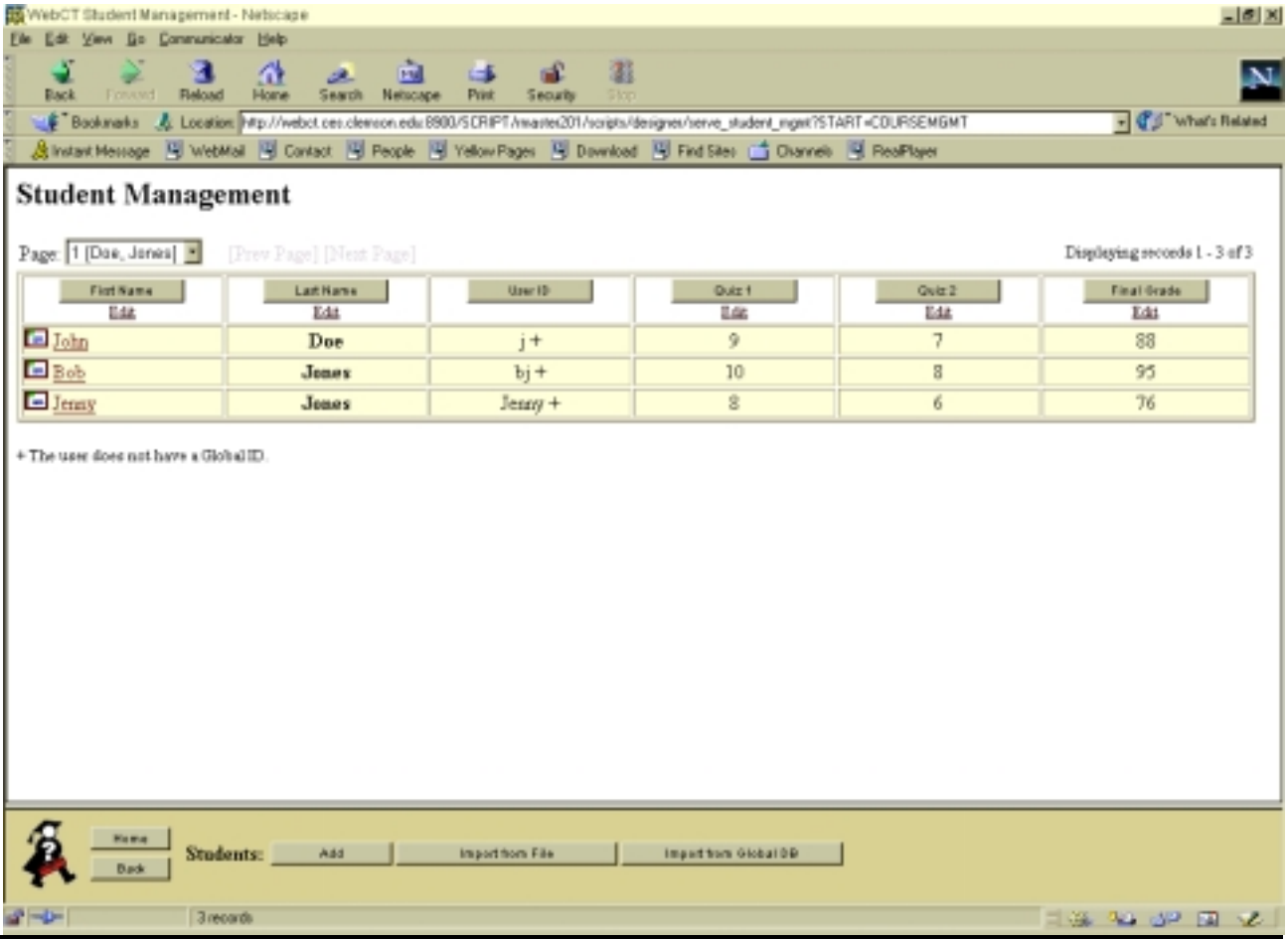

Figure 3.12: Screen showing grades of students for one of the course

Table 3.2: Testing methods: Knowledge

	A	B	C
Definition and Description	Basic knowledge of general principles or practices	Ability to select acceptable methods of accomplishing a task or objective. The student should be able to demonstrate by actually doing or following specific guidelines or procedures.	Ability to analyze and apply the correct concept or procedures. Ability to explain why certain procedures apply and others do not
	Assessment-Multiple choice questions or matching. Ability to identify and select key terms and words and match them with their correct meaning or definition. Students should be capable of explaining general maintenance and safety procedures; such as when to wear hearing and eye protection. Instructor may provide some guidance for clarification of concepts or procedures	Assessment-fill-in the blank and essays type questions. In addition, the students should be capable of completing simple maintenance tasks such as installing common hardware, following maintenance procedures in a repair manual, and limited troubleshooting	Assessment-fill-in the blank and essay type questions. In addition, the student should be capable of completing specific maintenance tasks such as timing an engine magneto, setting the float on a carburetor, and isolating an electrical problem using a wiring diagram. Student should be capable of performing the objective without assistance from the instructor
Taxonomy	<u>Skills Required</u>	<u>Skills Required</u>	<u>Skills Required</u>
	1. Remembering an idea, material, or phenomenon in a form very close to that in which it was originally encountered. 2. To recall 3. To recognize 4. To acquire 5. To identify	1. Understanding the literal message contained in a communication 2. Inherent movement patterns that are formed by combining of reflex movements and are a basis for complex skilled movements 3. To transform 4. To paraphrase 5. To interpret 6. To infer 7. To conclude 8. To manipulate	1. Knowing an abstraction well enough to apply it without being prompted or without having been shown how to use it. 2. Breaking down ideas into their constituent parts and detecting the relationship of the parts and the way they are arranged. 3. Interpretation of stimuli that enable one to make adjustments to the environment. 4. To generalize 5. To develop 6. To employ 7. To transfer 8. To distinguish 9. To detect 10. To restructure 11. To classify 12. Coordinated movements

Test Method	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	X	X	X	N/A	N/A	X	X	X

Table 3.3: Testing methods: Application

	A					B					C				
Definition and Description	No practical application Assessment-not measured					Limited practical application Assessment-Multiple choice questions or matching. Demonstration of correct methods and procedures relating to simple mechanical exercises or projects. Student should be capable of completing basic tasks on an aircraft such as replacing spark plugs, changing engine oil and filters, and minor servicing such as tires and accumulators. Limited instructor assistance may be provided to clarify procedures.					High degree of practical application Assessment-Essay and fill-in the blank type questions. Ability to analyze and apply the correct concept or procedures. Ability to explain why certain procedures apply and others do not. In addition, the student should be capable of completing specific maintenance tasks such as timing an engine magneto, setting the float on a carburetor, and isolating simple electrical problems using a wiring diagram. Student should be capable of performing the objective without assistance from the instructor.				
Taxonomy	<u>Skills Required</u> 1. No practical application 2. Assessment-not required					<u>Skills Required</u> 1. Breaking down ideas into their constituent parts and detecting the relationship of the parts and the way they are arranged. 2. Interpretation of stimuli that enable one to make adjustments to the environment. 3. To distinguish 4. To detect 5. To restructure 6. To classify 7. Coordinated movements					<u>Skills Required</u> 1. Breaking down ideas into their constituent parts and detecting the relationship of the parts and the way they are arranged. 2. Putting together elements and parts to form a new whole 3. Interpretation of stimuli that enable one to make adjustments to the environment. 4. To distinguish 5. To detect 6. To restructure 7. To classify 8. To produce 9. To plan 10. To combine 11. To decide 12. To compare and contrast 13. Coordinated movements				
Test Method	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)
	N/A	N/A	N/A	N/A	N/A	x	x	N/A	N/A	X	N/A	N/A	X	X	X

Table 3.4: Testing methods: Manipulative skills

	A					B					C				
Definition and Description	No development of manipulative skill					Development of manipulative skills to perform basic operations					Development of manipulative skills required to simulate "return to service				
	Assessment-not measured					Assessment-Students should be capable of completing basic maintenance tasks such as installing common hardware or safety wiring. The student should be capable of completing basic maintenance operations and servicing such as changing engine oil or installing spark plugs. Proficiency levels for time may not be met but the quality of the work should meet established industry standards. Limited instructor assistance may be provided to clarify procedures					Assessment-Students should be capable of performing complex maintenance tasks such as measuring clearance on crankshaft and rod bearing journals to determine proper bearing selections and wear limits, adjusting engine fuel metering systems to manufactures specifications, and isolating an electrical problem using a wiring diagram. Speed and accuracy are a prime consideration, maintenance tasks should be of such quality and accuracy to simulate return to service. The student should be capable of completing the tasks without instructor assistance.				
Taxonomy	Skills Required					Skills Required					Skills Required				
	1. No practical manipulative skills 2. Assessment-not required					1. Putting together elements and parts to form a new whole 2. Interpretation of stimuli that enable one to make adjustments to the environment. 3. Coordinated movements 4. To decide 5. To assemble					1. Endurance, strength, vigor, and agility 2. Putting together elements and parts to form a new whole 3. Interpretation of stimuli that enable one to make adjustments to the environment. 4. Coordinated movements 5. Quick, precise movements 6. To decide 7. To assemble				
Test Method	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)	Multiple choice	Matching	Fill in the Blanks	Essay	Demonstration (Hands-on)
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	X	N/A	N/A	X	X	X

Table 3.5: Mapping testing methods to performance objectives

GOS No.	Performance objectives	Skill	Level	Testing Methods					Task Factors				
				Multiple choice	Matching	Fill in the Blanks	Essay	Demons. (Hands-on)	Speed & Accuracy		Task Complexity		
									Imp.	Not Imp.	Low	Med	High
GOS 1	Ground operate aircraft engine, tow, taxi, and secure aircraft	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 2	Explain procedures and precautions for fueling and defueling aircraft certified under FAR Part 23 and 25	K	B	X		X	X	X	NA	NA	X		
		A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 3	Select the appropriate MSDS sheet for an item. Identify various safety information and warning(s) contained on the MSDS sheet.	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 4	Identify safety procedures required by OSHA, ICAO, and the EPA for handling hazardous material(s) around aircraft.	K	C	X		X	X	X		X			X
		A	C	X									
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 5	Identify hazards located around aircraft and hanger maintenance areas	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 6	Locate and explain safety practices and procedures for working around aircraft located on airport ramps	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GOS No.	Description	Skill	Level	Testing Methods					Task Factors				
				Multiple choice	Matching	Fill in the Blanks	Essay	Demons. (Hands-on)	Speed & Accuracy		Task Complexity		
									Imp.	Not Imp.	Low	Med	High
GOS 7	Locate and explain OSHA safety practices and procedures for confined space entry	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 8	Locate and explain OSHA Regulations related to aircraft maintenance activities	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 9	Identify safety practices and procedures required when working around aircraft jet blast areas	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 10	Perform aircraft interior, exterior, and powerplant cleaning	K	B	X		X	X	X	NA	NA	X		
		A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 11	Explain properties and the purpose of aircraft fuels, lubricants, and greases	K	B	X		X	X	X	NA	NA	X		
		A	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		MS	A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOS 12	Identify and select the proper aircraft fuel grade	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 13	Identify and select powerplant lubricants	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 14	Identify and select hydraulic fluids	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	

GOS No.	Description	Skill	Level	Testing Methods					Task Factors				
				Multiple choice	Matching	Fill in the Blanks	Essay	Demons. (Hands-on)	Speed & Accuracy		Task Complexity		
									Imp.	Not Imp.	Low	Med	High
GOS 15	Identify and select aircraft lubricants and oils	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 16	Identify and select propeller lubricants	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 17	Identify proper procedures and precautions for deicing an aircraft	K	B	X		X	X	X	NA	NA	X		
		A	B	X	X			X	NA	NA		X	
		MS	B	X				X	X			X	
GOS 18	Direct aircraft movement using standard hand signals	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	B	X				X	X			X	
GOS 19	Operate aircraft radios using proper communication procedures	K	C	X		X	X	X		X			X
		A	C	X		X	X	X		X			X
		MS	C	X		X	X	X		X			X

Table 3.6: Advantages and disadvantages of various test methods

Test method	Advantages	Disadvantages
Multiple Choice	1) Access memory, recall and comprehension 2) Thinking and reasoning behaviors 3) Sample a wide range of knowledge and skills in a short time period 4) can be designed to assess a variety of learning principles 5) cause and effect relationships 6) performance of mental processes 7) insight and critical analysis Factual Knowledge 8) measures Understandability 9) ability to apply concepts for knowledge to unique situations	1) guessing is a problem 2) tends to develop items that measure facts alone 3) coverage of content and skills may be limited 4) does not allow students to construct, organize, and presents their own answers
Matching	1) measures a trainee's ability to recognize relationships and make associations 2) measures factual knowledge and judgement 3) measure for who, what , when , where type of data 4) measure for application of knowledge	1) limited to accessing lower level behaviors 2) many areas of subject matter can not be tested with this method 3) poor measure of interpretation and understanding
Essay	1) ability to organize information and communicate that information effectively and efficiently 2) reason with or from the knowledge gained 3) can be used to tap learning planning, organization, integration, and effective expression of ideas 4) measures knowledge of facts 5) can measure higher levels of thinking, can encourage development of higher level thinking skills 6) encourages students to develop a comprehensive knowledge of specific facts and to discriminate among them	1) may discriminate against students that can not communicate effectively 2) inappropriate for measuring ability to select and organize ideas, writing abilities, and some types of problems-solving skills. 3) may be influenced by bluffing or poor writing skills 4) scoring is usually extremely unreliable 5) requires a great deal of scoring time provides only a small sample of the student's knowledge and ability

Test method	Advantages	Disadvantages
Short Answer and Fill in the Blank	1) effective in measuring recall 2) sample a wide range of subject matter 3) discriminate activity 4) free from guessing if constructed properly 5) basic concepts 6) definitions 7) descriptive information 8) isolated facts 9) who, what, where, when type 10) solution of problems or situation type material	1) tends to measure verbal ability and memorizing of facts rather than an application 2) extremely difficult to construct items that call for only 1 correct response 3) encourages trainee's to spend time memorizing 4) difficult to measure high levels of understanding
Laboratory Exercise	1) effective in measuring proficiency level in practical tasks 2) effective measure for measuring psychomotor skills 3) good for multi-domain learning 4) students solves a life-like problem that requires the identification of the issue and the selection for use of appropriate generalizations and skills	1) might discourage reasoning ability 2) testing process is generally time intensive 3) can not be performed with a large group of students.

Figures 3.13 through 3.16 show prototypical screens for the revised Gas Turbine Engine course. Figure 3.13 shows the homepage of the Gas Turbine Engines website. There are several features available on the website, which can easily be accessed from the homepage. These include course outline, calendar of course events, email, bulletin board, assignments, chat room, lectures, pictures, handouts and grades. Figure 3.14 depicts a sample picture that is used to supplement the lecture information. Pictures can be accessed two ways: by going to the Pictures link from the homepage or by going through the lecture notes and clicking on the appropriate link in the text. Figure 3.15 depicts the web page, which provides lectures available for the course. A sample slide from the lecture notes is shown in Figure 3.16. Using this web-site students and course instructor can communicate without being constrained by geographical proximity. The students can access all information pertaining to the course, use the e-mail facility to contact the course instructor and interact with members on team projects using the chat room facility. Each student can logon to the website from any place he/she has access to the World Wide Web.

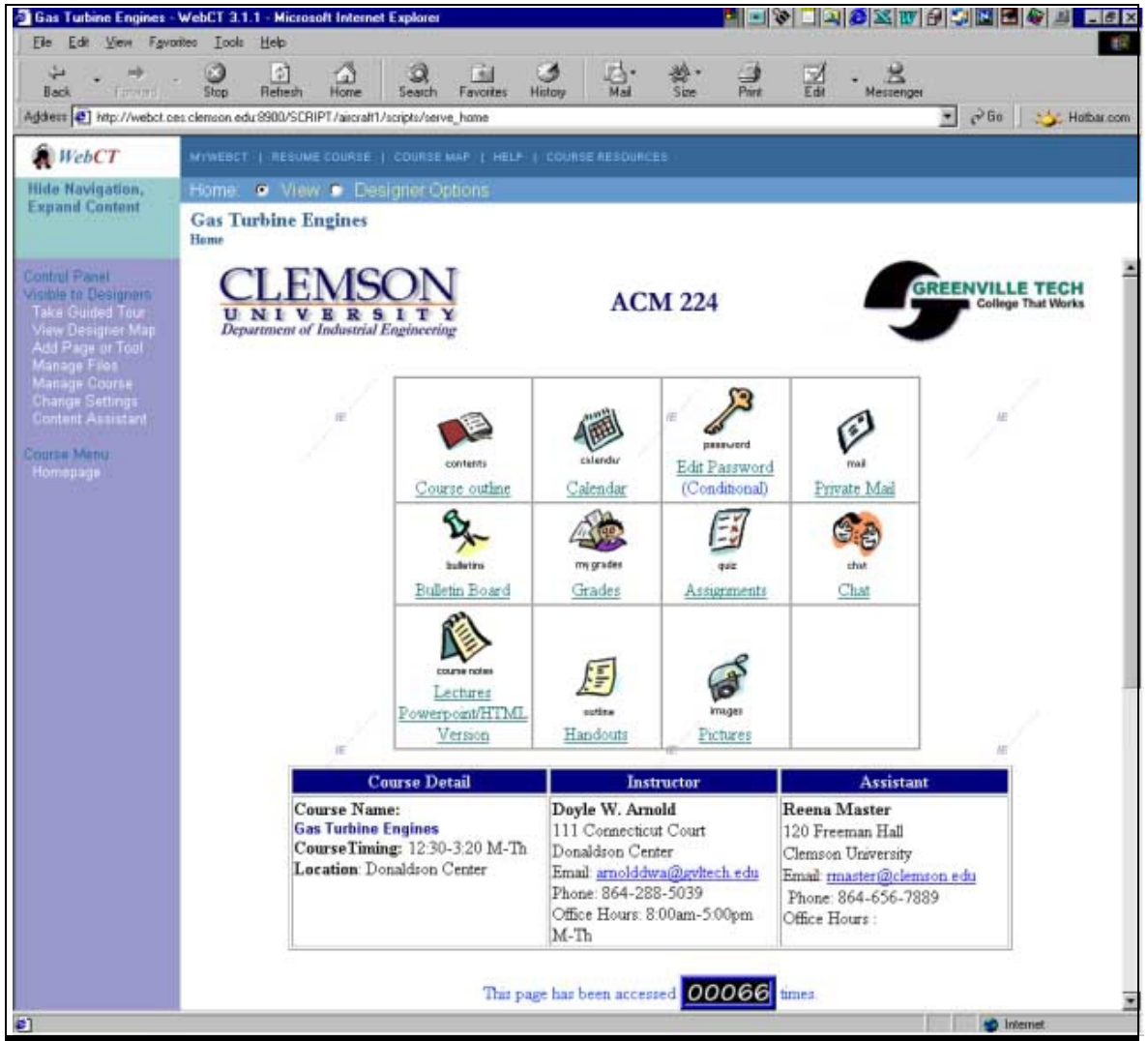

Figure 3.13. Homepage of Gas Turbine Engines website

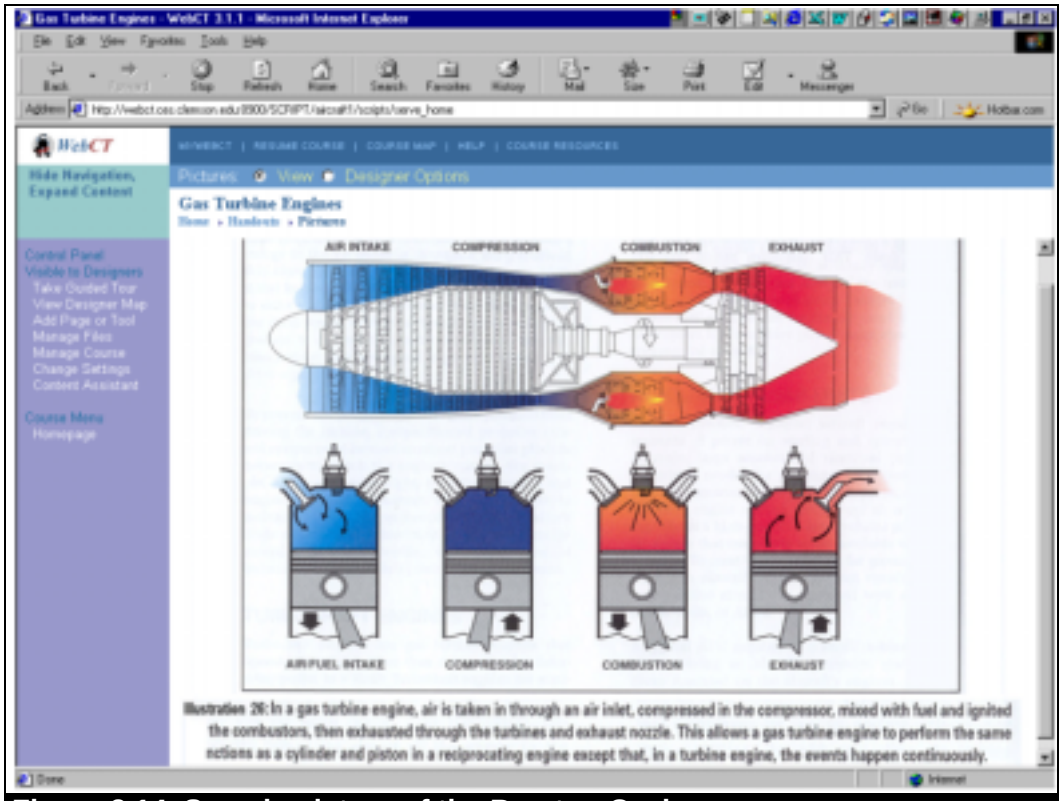

Figure 3.14. Sample picture of the Brayton Cycle

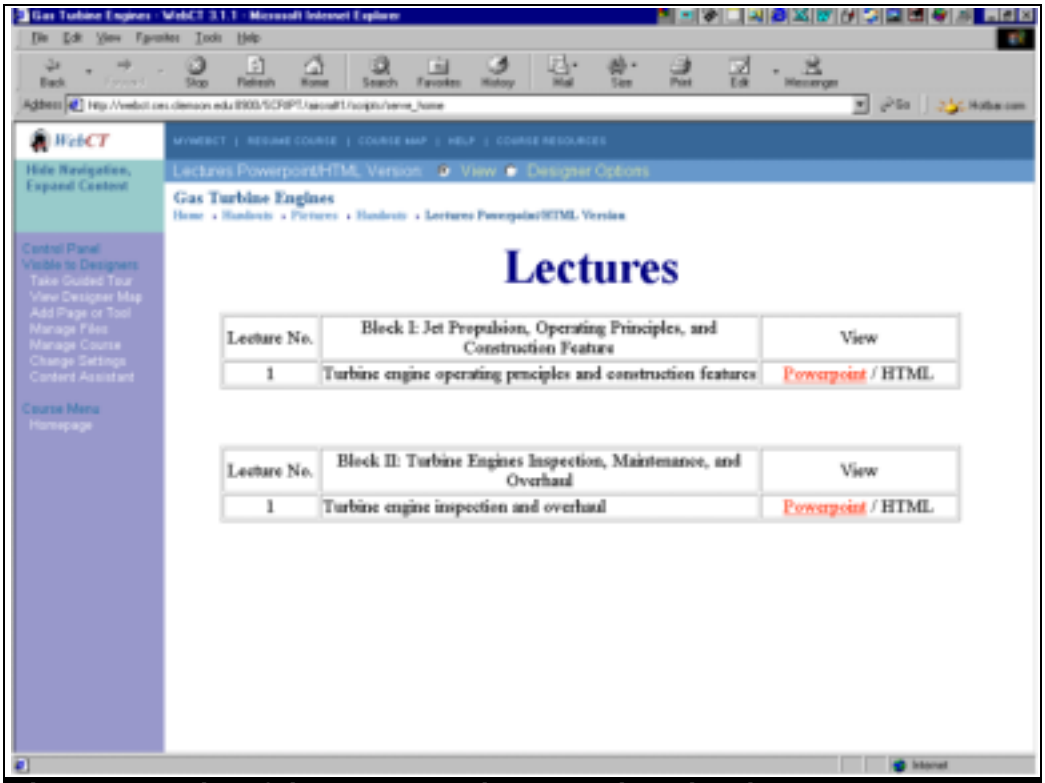

Figure 3.15. List of the course topics posted on the site

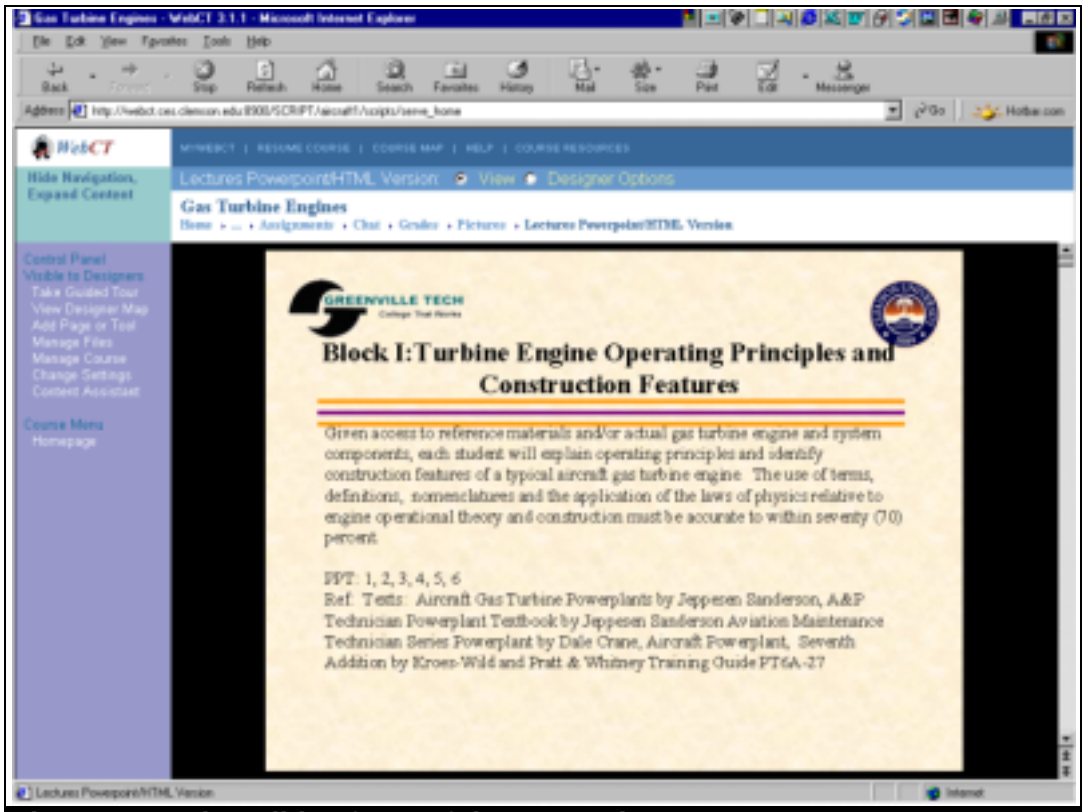

Figure 3.16 First slide of one of the course lectures

4. CURRICULUM ASSESSMENT

The classic closed-loop outcome based assessment methodology was used with the model for AMT/T and new FAR Part 66 curriculum (Figure 4.1) illustrating the paradigm.[15]

Methods of assessment were developed allowing the evaluators to determine whether or not the new curriculum has met program objectives and to test whether it has produced the desired learning outcomes and student behavior resulting in the desired performance levels. The assessment methodology evaluating the curriculum focuses on the following topics:

Implementation issues
Organizational issues
Teaching issues
Learning issues
Workload issues
Meeting FAA requirements
Tracking student skills
Tracking employer satisfaction
Tracking student performance

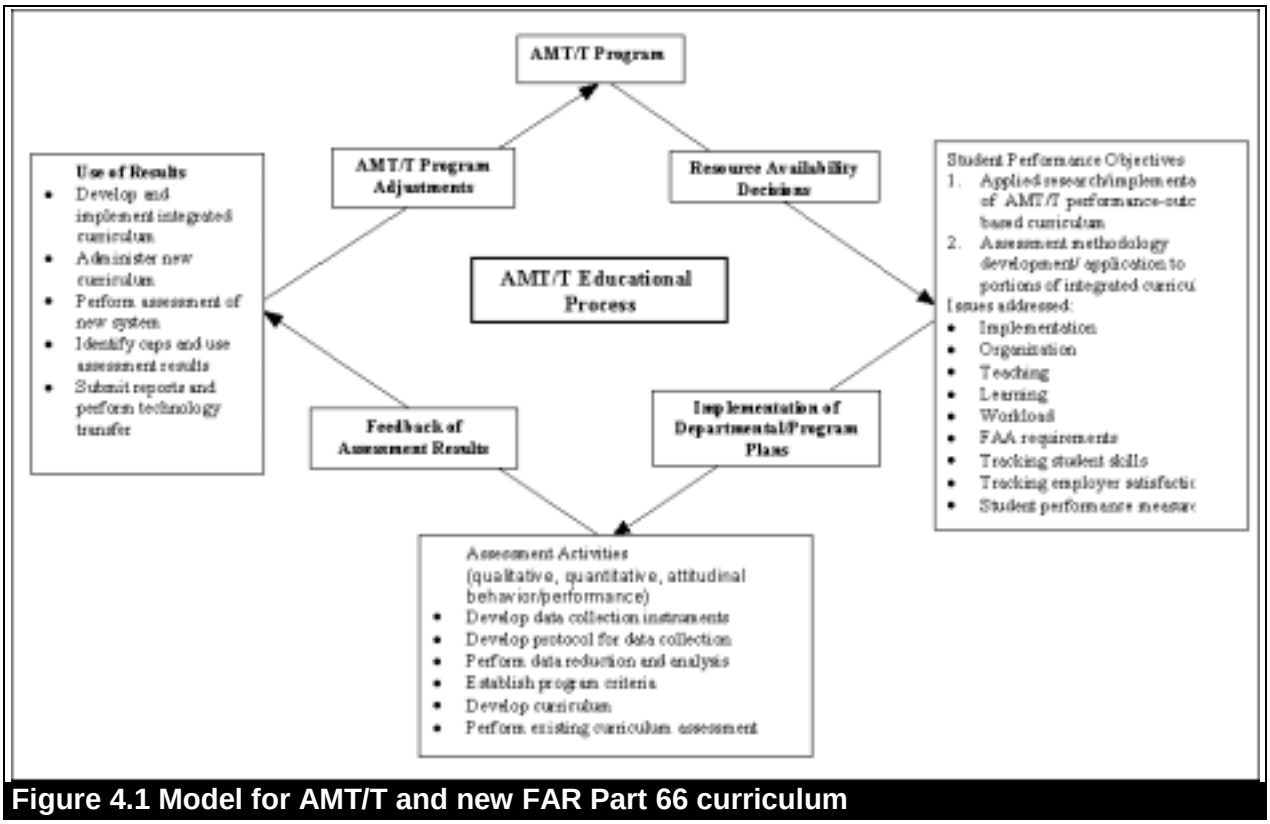

Figure 4.1 Model for AMT/T and new FAR Part 66 curriculum

While several assessment methodologies are in current use, they vary according to their suitability for different types of instruction. Thus, a battery of assessment tools was used. Some of the ones most commonly used are described below.

- Qualitative Assessment

  The advantages of qualitative assessment include the ability to judge the whole within a context, flexibility in assessment, and the potential for revealing unexpected findings. The typical qualitative assessment tools include oral examinations, interviews, and juried competitions.

- Quantitative Assessment (Cognitive, Attitudinal, Behavioral)

  Cognitive Assessment measures student knowledge of the curriculum material on three levels, the basic knowledge of general principles or practices; the knowledge of general principles, practices and operational concepts; and the highest level of knowledge involving principles, practices and operational concepts. Cognitive tests commonly used include standardized tests, locally developed tests by experts/instructors, and course grades.

  Attitudinal Assessment measures the beliefs and opinions of the students related to the learning context, their attitude toward the training process, and their role as an AMT. Data to support these findings can be obtained from alumni and students who complete the program.

  Behavior/Performance Assessment procedures assess the ability of the students to use and apply the knowledge as well as assessing their ability to perform tasks or processes with speed and accuracy acceptable industry standards**.**

Methods of assessment were developed that allow the evaluators to determine whether or not the revised course meets the desired objectives. In some cases existing instruments, including both qualitative and quantitative assessment tools, were modified for use. The specific tools used were as follows:

1. Teaching Evaluations (Figure 4.2)

   Objective: The objective of this evaluation is to obtain quantitative information on the course offering and the instruction through a standard questionnaire.

   Issues Addressed: Course content, learning strategy, delivery, use of class time, grading, tests, instructor's expertise.

   Timing and Protocol: The in-class evaluation is to be conducted by an assigned person not affiliated with the course toward the end of the semester/quarter by distributing the questionnaire.

   Feedback: Feedback forms are shared with the course instructor and the Program Director. Summary/Averaged information is shared with the entire faculty

2. Instructor's Course Evaluations (Figure 4.3)

   Objective: The objective of this questionnaire is to obtain instructor information on the course as it relates to availability of resources and student preparedness.

   Issues Addressed: Instructional support, Resource availability, Course preparedness, Use of new instructional material, Student preparedness.

   Timing and Protocol: The instructor completes the questionnaire at the conclusion of the course.

3. Independent Structured Interviews with the Entire Class and the Instructor Conducted Separately by the Program Director (Figure 4.4)

   Objective: The objective of this assessment is to obtain detailed opinion on the specific course offering from both the students and the instructor(s).

   Issues Addressed: The program director is tasked with soliciting opinion from students and instructors on the following: content of the course, delivery of instructions, availability of resources to support the course (e.g., projects), use of computers and advanced technology and other issues not addressed by teaching and course evaluations.

   Timing and Protocol: The students' interview should take place during assigned class meetings following teaching and course evaluations.

   Feedback: A summary report of the in-class interview is shared by the Program Director with the instructor of the course. A summary report of the instructor interview is shared with the entire faculty during regular faculty meetings.

4. Exit Survey (Figure 4.5)

   Objective: The objective of the exit survey is to solicit opinion from graduating students on the entire program and the educational experience.

   Issues Addressed: Program usefulness, Instructor evaluation, Course evaluation

   Timing and Protocol: Graduating students complete the survey in the final semester/quarter before their graduation.

5. Alumni Survey (Figure 4.6)

   Objective: The objective of the survey is to gather information on the program and identify ways to enrich it using alumni input.

   Issues Addressed: Job preparedness, Usefulness of skills learned, Limitations of the program, Suggestions for improvement by addressing industry needs.

   Timing and Protocol: The survey will be mailed to students with a minimum of one year of work experience and who continue to be employed by the aircraft maintenance industry or hold job titles related to the aircraft industry.

6. Employer's Survey of the Program and the Students (Figure 4.7)

   Objective: The objective of this survey is to solicit information from potential employers about the job preparedness of the students from the Greenville Tech AMT program and identify industry needs that can impact the overall program.

   Issues Addressed: Student's job preparedness, Future needs of the industry

Timing and Protocol: Administered annually to employers of Greenville Tech graduates and reviewed yearly by the faculty.

7. Course Information

   Detailed records will be kept on the following: average grades obtained in the course and scores on select exams, test/quizzes and projects. In addition to these, longitudinal portfolios for select students will be retained.

In addition to the above, other indicators and sources of data were used to provide information outside the scope of the formal assessment, and used primarily in assessing the quality and in seeking improvements in departmental processes, course content and delivery, facilities and student services. These include anecdotal information, which were used by the Chair or discussed by the faculty and led to actions for improvement.

Teaching Evaluation

Instructor's Name _____

Course Title _____ **Section** _____

Course Information

1. The course was well organized and outlined.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

2. The syllabus was distributed and explained at the beginning of the course.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

3. The textbook and course material supports learning.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

4. The test assignments and examination questions measure skills, concepts and objectives that are relevant to the course.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

5. The lab assignments supported my understanding of the course material.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

6. The equipment and supplies are adequate for completing lab exercises.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

7. The course projects were challenging and helped me in understanding the course.

1	**2**	**3**	**4**	**5**
Very Strongly DisAgree		Neutral		Very Strongly Agree

Figure 4.2: Teaching evaluation (Continued…)

8. The course projects/lab assignments were based on real-world aircraft maintenance situations.

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

9. The course required the use of computers

Yes No

10. If the answer to the above question is Yes, explain how computers were used in the course

Explain:

Instructor Information

11. The instructor treated students with respect

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

13. The instructor used the time effectively and efficiently

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

14. The instructor's teaching methods helped me understand the course material

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

Figure 4.2: Teaching evaluation (Continued…)

15. The instructor presentation material and class notes are of high quality

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

16. It is possible to easily access the presentation material during after-class hours

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

17. The method of delivering instruction was highly effective.

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

18. The instructor made adequate use of computers to support instruction

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

19. The instructor was enthusiastic about teaching.

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

20. The instructor's expectations were made clear to me.

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

21. The instructor motivated me

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

22. I will recommend this course to another student

1	2	3	4	5
Very Strongly DisAgree		Neutral		Very Strongly Agree

Figure 4.2: Teaching evaluation (Continued…)

Student Information
1. I am satisfied with my accomplishments in this course,

Yes **No**

2. I expect to receive the following grade on this course.

A **B** **C** **D** **Fail**

Write your responses to the following questions:

1. Please list the strengths of the course and /or instructor?

2. Please list the weaknesses of the course and /or instructor?

3. Please provide suggestions to improve the course.

Figure 4.2: Teaching evaluation

Instructor's Questionnaire

Instructor Name_____ Course_____ Year_____ Qtr_____

Please provide information to the following questions

Self

I am extremely qualified in teaching this course

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

I was extremely well prepared in teaching this course

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

I used computers to support classroom teaching and delivering of instruction

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

Course Content

The course content represents state of the art and the latest advancements in this topical area.

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

The course uses hands-on projects that are representative of real world situations

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

Figure 4.3: Instructor's course evaluation (Continued…)

The course makes use of team projects

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

The facilities and resources provided to support the course are excellent

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

The course integrates computer experience as part of projects and classroom teaching

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

The course provides introduction to human factors knowledge that is relevant to the course

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

Student Preparedness

Students had suitable background and were qualified in taking this course

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

Students showed initiative and were motivated

1	2	3	4	5	6	7
Very Strongly Disagree						**Very Strongly Agree**

Please provide additional comments that will help strengthening of the course offering:

_____

_____

Figure 4.3: Instructor's course evaluation

CLASSROOM EVALUATION FORM

Instructor Observed _____ Course (section) _____
Observer _____ Date _____

I. SETTING

A. Teaching method used in this class includes (check all that apply):

☐ Lecture ☐ Student Presentation ☐ Class Discussion

☐ Lab Work ☐ Other _____

B. Student Involvement Takes the Form of (check all that apply):

☐ Taking Notes ☐ Asking/Responding to Questions

☐ Participating in ☐ Working on Projects

☐ Making Presentations ☐ Other _____

II. PLANNING & ORGANIZATION (A = Acceptable; N = Needs Improvement)

☐ A. Begins class on time in orderly, organized fashion.
☐ B. Clearly states goals or objectives for the period.
☐ C. Reviews prior material as necessary.
☐ D. Summarizes and distills main points at end of class.
☐ E. Appears well prepared for class.
☐ F. Assignments are clearly stated.

_____
_____
_____

Figure 4.4: Classroom evaluation form (Continued…)

III. PRESENTATION (A = Acceptable; N = Needs Improvement)

- ☐ A. Incorporates various instructional supports like slides, diagrams, models, board, etc.
- ☐ B. Board writing is large and legible.
- ☐ C. Establishes and maintains eye contact with class.
- ☐ D. Responds to changes in student attentiveness.
- ☐ E. Use of humor is positive and appropriate.
- ☐ F. Communicates sense of enthusiasm and
- ☐ G. Presentation style facilitates note-taking.
- ☐ H. Speaks audibly, clearly, effectively.
- ☐ I. Selects teaching methods appropriate for content.
- ☐ J. Uses clear, relevant examples to illustrate

_____
_____
_____

IV. INTERACTION AND RAPPORT (A = Acceptable; N = Needs Improvement)

- ☐ A. Promotes student feedback and interaction.
- ☐ B. Knows and uses students' names.
- ☐ C. Recognizes when students do not understand.
- ☐ D. Encourages mutual respect between students.
- ☐ E. Gives students enough time to respond to questions.
- ☐ F. Responds to wrong answers and comments constructively, without deprecation.
- ☐ G. Presents challenging questions to stimulate discussion.

_____
_____
_____

Figure 4.4: Classroom evaluation form (Continued…)

V. Content (A = Acceptable; N = Needs Improvement)

- ☐ A. Selects relevant examples and applications to comment course content.
- ☐ B. Integrates text material into class presentations.
- ☐ C. Relates current course content to students' general education.
- ☐ D. Presents views other than own when appropriate.
- ☐ E. Seeks to apply theory to problem solving.
- ☐ F. Explains terms, concepts, or problems in more than one way.
- ☐ G. Presents background of ideas and concepts when appropriate.
- ☐ H. Relates assignments to course content.

VI. ADDITIONAL COMMENTS

Figure 4.4: Classroom evaluation form

EXIT SURVEY

Return to:
AMT program,
Greenville Technical College,
Greenville, SC.

Name: _____
Last First Middle Today's date

Social Security No.: _____ Sex: M F Marital Status: M S

Date of Birth: ___/___/_____ Graduation Date: ___/___/_____ GPR: _____

Current Address:
_____

(Circle Appropriate Responses Below)
Degree from G'Tech: Co-Op: Yes No

Work Plans: Number of job offers: _____ Salary range: $ _____ to _____

Accepted Employer's Name & Location: _____

_____

YOUR OPINION ABOUT THE CURRICULUM EMPHASIS IN YOUR MAJOR

(Check appropriate responses below)

	TOO LITTLE	ABOUT RIGHT	TOO MUCH
English	_____	_____	_____
Mathematics	_____	_____	_____
Physics	_____	_____	_____
Humanities	_____	_____	_____
Engineering and technology	_____	_____	_____
Computer Utilization	_____	_____	_____
Curriculum Overall	_____	_____	_____

What Course did you find the most beneficial to your career path? _____

What Course did you find the least beneficial to your career path? _____

What did you like most about your department? _____

What did you like least about your department? _____

_____

Figure 4.5: Exit survey (Continued…)

Please rate from 1 to 5 the teaching effectiveness of the faculty members listed below. List the courses by catalog number which you had under the given faculty member. Only rate those members with whom you have had actual classroom contact.

Rating Scale:

1. Outstanding
2. High Satisfactory, Very Good
3. Satisfactory, Good
4. Adequate, Fair
5. Unsatisfactory

Name	Rating	Course Number(s)	Comments
Allen Branch	_____	_____	_____
Bill Kendall	_____	_____	_____
Glenn Saccone	_____	_____	_____
Frank Webb	_____	_____	_____
Jacob Wilson	_____	_____	_____

AMT COURSE EVALUATION

	Course	High Value		Average Value		Low Value
GK	General Knowledge Instructional Unit	5	4	3	2	1
MKS	Basic Maintenance Knowledge and Skills Instructional Unit	5	4	3	2	1
ADAS	Aircraft Documentation and Administrative Skills	5	4	3	2	1
GOS	**Ground Operation & Safety**	5	4	3	2	1
	Aircraft Powerplant Instructional Unit					
PPT	**Turbine Engines**	5	4	3	2	1
PPR	**Reciprocating Engines**	5	4	3	2	1
PPP	**Propellers**	5	4	3	2	1
	Aircraft Electronics and Integrated Systems Instructional Unit					
AEIS-ET	Electrical Theory	5	4	3	2	1
AEIS-MP	Maintenance Practices for Electrical Systems	5	4	3	2	1
AEIS-EP	Electrical Power Generation Systems	5	4	3	2	1
AEIS-CNW	Communication, Navigation and Warning systems	5	4	3	2	1
AEIS-FMS	Flight Management Systems	5	4	3	2	1
ASYS	Aircraft Systems Instructional Unit	5	4	3	2	1
ASTR	Aircraft Structures Instructional Unit	5	4	3	2	1
AIC	Aircraft Inspections and Capstone Objectives Instructional Unit	5	4	3	2	1

Other comments or suggestions about the AMT Department:

_____

_____

Figure 4.5: Exit survey

Alumni Survey

Date of Graduation:Month: _____ Year: 200__

The following questions deal with issues specifically concerning the Aircraft Maintenance and Technology Program. Please respond by circling the number of the appropriate response.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The AMT program prepared me well for the practice of aircraft maintenance related work…….	1	2	3	4	5
2. In comparison with my co-workers who graduated from other programs, I rate my education superior to theirs ……..	1	2	3	4	5
3. My program prepared me well in the use of computers and computational techniques ……..……..	1	2	3	4	5
4. My preparation in communication skills (written/oral) was excellent.	1	2	3	4	5
5. The overall quality of my department was excellent (compared with the rest of the College/University) ……	1	2	3	4	5
6. The departmental laboratory experience/projects prepared me well for the practice of my discipline ……..……...	1	2	3	4	5
7. The overall departmental environment enhanced my education ……..	1	2	3	4	5

8. Which of the following general categories best describes your current work assignment?

1) Maintenance
2) Manufacturing
3) Management
4) Office work
5) Continuing education
6) Unemployed
7) Other (specify) _____

9. What type of continuing education programs have you participated in? (circle all that apply)

1) Formal graduate program
2) Selected formal courses
3) Non-credit short courses (one or more days)
4) Correspondence courses
5) None of the above

11. What do you do to consider to be the greatest strength of your Aircraft Maintenance and Technology program?

12. What do you consider to be the greatest weakness of your Aircraft Maintenance and Technology program?

13. What one or two specific curriculum changes would you recommend? Why?

14. Please provide (on back if necessary) any additional comments/suggestions concerning your department.

Figure 4.6: Alumni survey

GREENVILLE TECH
College That Works

EMPLOYER EVALUATION

Dear Employer:

At this time of year, Greenville Tech is once again reminded of the many opportunities you afford our graduates, and we appreciate the confidence you have placed in them. As we follow up on the progress they have made, we request your assistance in completing this evaluation. As you may know, the Employer Evaluation, which is an in-house confidential report for our administrative staff, will help us in assessment of current Greenville Tech programs, program planning, and development for the future.

Please complete both sides of this questionnaire on this present or former employee and return it in the enclosed envelope. This graduate has given us permission to contact you, and for your projected time frame we are asking that this evaluation be returned by June 4.

If you have any questions you may call Rhonda Topper at (864) 250-8478. Thank you for your cooperation. Please also include any suggestions you may have on improving our programs, as we are very interested in helping our graduates become more productive employees. Your evaluation will help us achieve this goal!

Sincerely,

Thomas E. Barton, Jr.
President

EMPLOYER: **SUPERVISOR:**

GRADUATE DATA:

GRADUATE"S CURRENT STATUS

Is this graduate still employed by this company? ☐ Yes ☐ No

Graduate's job title: _____

If no longer employed: ☐ ☑ Y ☑ N o

Reason for resignation or termination:_____

_____

Figure 4.7: Employer evaluation form (Continued…)

QUALITY OF EDUCATIONAL PREPARATION

Please indicate how well Greenville Tech prepared this graduate for employment with respect to each of the areas/competencies listed below.

	EXCELLENT	GOOD	NEEDS IMPROVEMENT	POOR	NOT APPLICABLE
Technical knowledge and job skills	☐	☐	☐	☐	☐
Attitude toward work	☐	☐	☐	☐	☐
Human relations skills	☐	☐	☐	☐	☐
Ability to learn on the job	☐	☐	☐	☐	☐
Comprehend and generate effective written and oral	☐	☐	☐	☐	☐
Demonstrate research skills necessary for personal and professional purposes	☐	☐	☐	☐	☐
Apply mathematical skills appropriate to solve day-to-day, as well as work-related, problems	☐	☐	☐	☐	☐
Demonstrate knowledge of computer applications compatible with job demands	☐	☐	☐	☐	☐
Exhibit professionalism appropriate to the values and ethics of his/her chosen career	☐	☐	☐	☐	☐
Demonstrate the critical thinking and problem-solving skills to fulfill work and personal responsibilities	☐	☐	☐	☐	☐
Practice interpersonal skills and teamwork in his/her professional life	☐	☐	☐	☐	☐
Demonstrate an awareness and understanding of various cultures	☐	☐	☐	☐	☐
OVERALL JOB PREPARATION	☐	☐	☐	☐	☐

ADDITIONAL INFORMATION

Would you be willing to serve on an advisory committee for this program? (Three – four meetings per year) ☐ Yes ☐ No

If another position were available, would you consider hiring a graduate from the same Greenville Tech program? (If no, please explain below.) ☐ Yes ☐ No

Please make comments and/or suggest ways Greenville Tech can better meet your need _____

Figure 4.7: Employer evaluation form

4.1 Offering 1 Curriculum Assessment

In-class teaching evaluations were completed for the three courses, Ground Operations and Safety, Aircraft Powerplant (Gas Turbine Engine Model), and Aircraft Structures. Data obtained from the teaching evaluations were analyzed using the Wilcoxon test (Tables 4.1 through 4.9).

Table 4.1: Teaching evaluation: Course 1

Question #	Responses				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	34			8	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	16	18	6	1	1

Table 4.2: Student information: Course 1

Student #	Question #		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
1	Good material, up-to-date aircraft	Hard to understand	Have the instructor explain himself
2	I learn a lot about airplanes. The instructor seems enthusiastic about the things we do. He provides an in-depth explanation of the things we go over.	The instructor needs to be clearer when we are in the classroom. I tend to get confused until we are in the hangar.	I would like it if we could do more hands on projects. Like working with the engines or letting us figure out how things work.
3	Hands on get to know more.		
4	It would lead you to knowing more about airplanes.	Not enough work in the labs	I suggest that we work on the engines a little more than we do. I think it would be easier to learn if it was a lot of hands-on-work.
5			
6	The instructor is able to communicate with students in a calm and professional manner.		
7	Instructor is nice and relates to students personally.		
8	The instructor knows what he is doing, he's been in this longer than us. He explains all the material to us without making us confused.	I think he needs to let us do more hands on work, it helps me to do and understand better.	

Student #	Question #		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
9	Textbooks are very helpful and the hands on make it more fun and easier to learn. Being able to work in pairs and groups on project help greatly. The class being smaller also helped because we could all take turns working on projects. We were all able to do everything ourselves. Comment: I have learned a lot in this course and I really enjoyed working with the planes.	Should have more studying, assignments to insure that the students know everything there is to know about this section of A.M. Needs to encourage the students to read the textbook.	Thorough explanations of each section (by the book) that was nothing is left out that may be important. Perhaps you could have two or three class dealing with different sections of A.M. so that the student can have a choice as to which course he/she wants to start with. (when you have more students of course).
1	Attendance 100%	None	
2			
3			
4	The course had hands on experience	You have to sit there and wait if you are not involved in the activity	
5	Labs, Tests	Lecture	Living up the lectures
6		None	Need help in lab. More instructors or qualified people to help start and taxi aircraft.
7	Frank is great at what he does. The grade is my fault	None	None
8	Course has basic skills in aircraft maintenance. Instructor is very fair, honest, and extremely knowledgeable.	None	Better Equipment
9	He gets the point across	Can ramble on	None
10	Teaches everything		
11	Instructor is very good	The tests are very tricky	I like the course as it is

Student #	Question #		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
12	Mr.Webb's knowledge of the subject is highly respectable. He is the instructor, which I have most enjoyed thus far. I would recommend his class to anyone. Also quite pleasant to talk to outside the class.	The only complaint I have about the course is, due to the size of the class (amt. of students) some of the lab activities (towing, aircraft runs, etc.) seemed rushed or could only be performed one time. This is in no way a reflection upon Mr. Webb's presentation of the material. As previously stated, I feel he is a wonderful instructor with professional knowledge of the subject.	
13	This course helps people to get a better understanding of motors, towing, starting the aircraft.	We need more instructors so that we can get more accomplished during towing and engine runs so we won't have to sit around and wait.	More instructors to help us with motor runs and towing so that we don't have to sit around and wait.
14	Instructor is well organized, Highly skilled and has a vast encyclopedia of aircraft knowledge and wisdom inside his mind. He makes you really pull all the information out of your mind on his tests. But you know what you are doing.	The course was sort of fast paced, but given thoroughly. The weight and balance portion could be a little more detailed.	Suitable equipment for the lab. Field trips to real facilities as a lab course.
15			
16	Exact detail and correctness of instructor requires you to know and remember the material.	Not enough time.	Make it a smaller class or have 2 instructors during lab exercises.
17	The instructor is knowledgeable and is still interested in the aircraft (after all these years) His enthusiasm is motivational.	Time restraints for the course.	

Student #	Question #		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
18			
19	Class size made several tasks difficult to accomplish with any more than minimal familiarization. Instructor's real world experience made for invaluable insights.	Class size made several tasks difficult to accomplish with any more than minimal familiarization.	Teaching assistants to provide for availability to access lab equipment.
20	Instructor is very knowledgeable of the material.	Questions on the exams are vague. They are designed not to test a student's knowledge base, but to trick you into making a mistake. That is wrong!	
21	The instructor did very well managing the large number of students with the time available.	Not enough time.	Split the class in 2 batches.
1	Providing adequate information and learning opportunities in real world situation. Instructor explained material to the best of his knowledge. Labs well planned and all safety precautions taken.	Course:-none, Instructor at times seem nervous	Allow for more hand-on learning opportunities
2	Good communication skills and a great personality	Doesn't have the ability to instruct. Thinks because he's never taught anything. The whole class in general didn't learn anything	Gary should sit in James or Bills class and be trained how to instruct by the way they do. These guys have a military instructors background
3	Good background in the field of study and genuinely tries to help students learn	Lab equipment inadequate-some broken or unable to be used, schedule conflicts between the classes	More equipment, better pm
4	None		

Student #	Question #		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
5	Access to actual aircraft and applying course knowledge	Not enough classes	More shop exercise
6	Does pretty good w/labs but has a hard time respecting students	None	More lab with equipment that works. No schedule conflicts between the classes and interference by the students of other classes
7	None	Instructor doesn't understand his own questions	none
8	None	None	None
9	None	None	None
10	More organized instructor and class time utilized constructively	Moments during labs when safety procedures were not followed and activities disorganized. Some of lab equipment are outdated and doesn’t work	Improve lab equipment, conduct safer lab experiments
11	None	Lacks in understanding the course	More equipment to work with
12	Time well used for most part	Not familiar with material he was teaching, not prepared for questions, could not answer his own question, seemed disinterested	Replace instructor with one Qualified to educate students
13	None	None	None

Table 4.3: Student responses: Course 1					
Question #	**Likert Scale**		**Compared Mean**	**Mean(S.D.)**	**Wicoxon test**
	1	**5**			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	4.19 (0.98)	($p<0.05$)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.60 (0.76)	($p<0.05$)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	4.42 (0.79)	($p<0.05$)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	4.19 (1.03)	($p<0.05$)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.40 (0.79)	($p<0.05$)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	4.09 (1.15)	($p<0.05$)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.10 (0.90)	($p<0.05$)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	4.31 (1.01)	($p<0.05$)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.58 (0.82)	($p<0.05$)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.39 (0.82)	($p<0.05$)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	4.41 (0.85)	($p<0.05$)
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.17 (1.07)	($p<0.05$)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	4.03 (1.14)	($p<0.05$)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wicoxon test
	1	5			
16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.79 (1.10)	($p<0.05$)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.98 (1.01)	($p<0.05$)
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	2.13 (1.07)	($p<0.05$)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	4.19 (0.93)	($p<0.05$)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.26 (0.98)	($p<0.05$)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	3.91 (1.11)	($p<0.05$)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	4.19 (1.14)	($p<0.05$)

Question #	Responses	
9. The course required the use of computers.	Yes	No
	1	42
10. If the answer to the above question is Yes, explain how computers were used in the course.	No comments	

Table 4.4: Teaching evaluation: Course 2					
Question #	**Responses**				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	9			6	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	1	8	3	3	0

Table 4.5: Student information: Course 2			
Student #	**Question #**		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
1			
2			
3		The instructor has a very negative attitude towards the school and tries to make the students feel like failures. The instructor has nothing good to say about any work done in the Lab. Makes derogatory remarks to students when students do well on exams	
4			
5	Very informative		More Lab time.
6	Promotes learning environment. Tries his best to help students understand and use what they learn	Lab equipment needs upgrading, needs to be a little more enthusiasm	Better equipment
7			
8			
9			
10	Teaches enough material to understand sheet metal. Lab activities were fun and interesting.	Lack of upto date tools. Not enough Lab time. Instructor was not thorough enough when helping in Lab.	Larger facilities for Lab hours, better quality tools, longer class and Lab hours
11	Knowledgeable on material, but not enough time spent in Lab.	Knowledgeable on material, but not enough time spent in Lab.	More Lab time to apply classroom lessons
12			
13	The course is tested too strongly in areas that are less important. For instance, in setting up rivet rows, pitches and patterns the # of rivets can vary, but on the test he grades too harshly if the # of rivets aren't exact.	The instructor does not motivate the class at all.	A new instructor
14	Well organized. Good notes	Instructor showed no enthusiasm. Was not supportive to us during labs. Only criticized performance.	Have an instructor that wants students to succeed not fail!
15	Knowledge of Course material	Negative Attitude towards A & P opportunities	

Table 4.6: Student responses: Course 2

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	3.87 (0.74)	($p<0.05$)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	3.93 (0.88)	($p<0.05$)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	3.87 (0.74)	($p<0.05$)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	3.87 (0.83)	($p<0.05$)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.87 (0.83)	($p<0.05$)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	3.53 (1.06)	($p>0.05$)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.93)	($p<0.05$)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.98)	($p<0.05$)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	3.20 (1.32)	($p>0.05$)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	3.60 (1.06)	($p>0.05$)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	3.93 (0.80)	($p<0.05$)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.53 (0.99)	(p>0.05)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	3.40 (0.99)	(p>0.05)
16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.00 (1.20)	(p>0.05)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.40 (0.83)	(p>0.05)
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	2.29 (1.03)	(p<0.05)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	3.13 (1.13)	(p>0.05)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	3.73 (1.16)	(p<0.05)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	2.73 (1.10)	(p>0.05)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	3.07 (1.39)	(p>0.05)

Question #	Responses	
9. The course required the use of computers.	Yes	No
	0	14
10. If the answer to the above question is Yes, explain how computers were used in the course.	No comments	

Table 4.7: Teaching evaluation: Course 3					
Question #	**Responses**				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	14			1	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	8	5	2	0	0

Table 4.8: Student information: Course 3			
Student #	**Question #**		
	1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
1		More turbines to work on more updated lab work	
2	Material & AC is outdated	Old airplanes, worn out tools and equipment.	Teach what student will do in reality, break up class time and labtime
3			
4	Experience level of the instructor	Need to cover more real time jet engines &split 50/50 with general aviation	
5		Need to update technology, to equal the way these fbo operate	Stop teaching in depth functions
6	Instructor was fair	Lab project were unacceptable, tooling was not good, learning aids were old	Get up to date materials, provide proper tools
7	Very informative course about general light aircraft maintenance.	Course needs to cover more on large commercial aircraft maintenance	
8			
9	Instructor well prepared and willing to teach	Instructors text book and prescribed text book are different	Change powerplant books, better lab equipment
10	Good instructor		Update equipment./special tools
11	Promoted good hands on general aviation A/C	Need to work in section and hands on maintenance for AC	One particular text book and not multiple books
12	Instructor is thorough and effective	Powerplant book not adequate	Better tooling in lab, better vending area at the satellite location at donaldson center.
13			
14	Material in text book along with lab was put to good use	Different text book used by instructor made the course confusing	Instructor needs to control class cut ups better
15	Clear concise instruction, demonstration of hands on techniques		Improve lab equipment

Table 4.9: Student responses: Course 3

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.82)	($p<0.05$)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (0.70)	($p<0.05$)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	3.33 (1.18)	($p>0.05$)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	3.93 (1.03)	($p<0.05$)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.60 (0.74)	($p<0.05$)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	2.40 (0.98)	($p>0.05$)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.47 (0.83)	($p>0.05$)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	3.27 (0.88)	($p>0.05$)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.74)	($p<0.05$)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (0.80)	($p<0.05$)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.80)	($p<0.05$)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.65)	(p<0.05)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.62)	(p<0.05)
16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.93 (0.59)	(p<0.05)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.73 (0.88)	(p<0.05)
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	2.29 (1.03)	(p<0.05)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	4.33 (0.62)	(p<0.05)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.33 (0.62)	(p<0.05)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.70)	(p<0.05)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	3.80 (1.15)	(p>0.05)

Question #	Responses	
9. The course required the use of computers.	Yes	No
	0	15
10. If the answer to the above question is Yes, explain how computers were used in the course.	No comments	

4.2 Offering 2 Curriculum Assessment

Details on the assessment as they would potentially impact the above issues and their implications for use of technology and human factors in improving the AMT curriculum and course instruction are shown in this final report. As shown earlier, in-class assessment was conducted on the old offerings of the three courses, Ground Operations and Safety, Gas Turbine Engines and Aircraft Structures. Data obtained from the teaching evaluations for the revised offering of Ground Operations and Safety course in year 2 are summarized in Tables 4.10 and 4.11. The data for each question was also analyzed using the Wilcoxon test (Tables 4.12). Results of the alumni survey are also summarized in Tables 4.13 –4.14.

Table 4.10 Student Information: Ground Operations and Safety (revised)

Question #	Responses				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	14			1	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	8	7	0	0	0

Table 4.11 Teaching evaluation: Ground Operations and Safety (revised) (Continued)

Question #		
1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
Lab was well related to the computer slides/lectures	Some information is somewhat different	Slides should be more than just short outline, should be more specific
Able to communicate well, good knowledge of material covered, good relationship with students	None	More working with aircraft
Good knowledge	None	Course is fine, there should be no changes
Willingness to help, good overall knowledge	Limitations	
Student has a lot of hands-on material	In Computer lab students do browsing other than that related to the course	None

Table 4.11 Teaching evaluation: Ground Operations and Safety (revised)

Course helped to learn everything about the airplanes, when they are on the ground, how to fuel, how to jack a airplane, and trouble shooting. Instructor explains everything	None	More time in the hangar, less time in the class room
All is good what he teaches.	Sometimes it is not clear what is expected for quizzes and exams	none
Practical experience of instructor/ Fair and Impartial / Kept class interest up. Good hands on experience	Too much emphasis on computer skills to the detriment of hands on skills	Less dependant on computer information and more hands on experience in hangar
Real life aviation maintenance experiences. More doing and less lip service. Good to access the materials at home	Instructor depends too much on the computer screens for lecture	Instructor could use a lab assistant
Good teacher, labs were good due to hands on experience	Content on the internet, studying became difficult as I don't have a internet	Put the course back on the paper, since I couldn't study as I didn't have a computer
Good material	Needs handouts on some sections	More handouts and papers are required for lab
Hands on training	Not having time to take notes or obtain them without computer yet	More time for course
Computers, Good instructor, labs		
Instructor has lots of experience in the field	Computer program is not easily accessible at home due to high price of software	Get rid of computers and get html online version working
Lot of hands on projects	High cost of software for accessing	Get rid of computers

Table 4.12 Student responses: Ground Operations and Safety (revised) (Continued)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.70)	($p<0.05$)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.60 (0.63)	($p<0.05$)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.59)	($p<0.05$)
4. The test assignments and examination questions measures skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.70)	($p<0.05$)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.74)	($p<0.05$)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (0.80)	($p<0.05$)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.64)	($p<0.05$)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	4.79 (0.43)	($p<0.05$)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.80 (0.41)	($p<0.05$)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.52)	($p<0.05$)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.64)	($p<0.05$)
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (0.80)	($p<0.05$)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.98)	($p<0.05$)

Table 4.12 Student responses: Ground Operations and Safety (revised) (Continued)

16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.53 (1.81)	($p<0.05$)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.87 (1.06)	($p<0.05$)
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.64)	($p<0.05$)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.52)	($p<0.05$)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.40 (0.51)	($p<0.05$)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.76)	($p<0.05$)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (0.88)	($p<0.05$)

Question #	**Responses**	
9. The course required the use of computers.	Yes	No
	14	1

10. If the answer to the above question is Yes, explain how computers were used in the course.	They contained the info about this course and were used for the majority of the lecture part of the class.
	ATP navigator program to use the maintenance manual. Powerpoint to present lectures. Internet Explorer to check MSDS.
	Powerpoint, ATP Navigator, C-172 CDT, Internet Explorer, C90
	The computers make the info we need as well as illustrated pictures available at any time, so assignments and class demonstrations can be finished quickly and easily.
	To look up important info.
	The computers were used to look up answers, show diagrams of airplanes, and help learn everything about the course.
	For lectures and ATP's.
	Look up text materials and maintenance info on specific aircraft.
	Used to present lecture materials and research.
	The whole course was on computer.

	For text and diagrams to learn on.
	Very helpful as a guide with pictures, presentations, as well as instructor guiding.
	The material on the slides of the computers was given on test and quizzes and also to reference maintenance manuals.
	Information for the course came from an online program called Powerpoint.

Table 4.13 Alumni survey results

Question	Mean (Std. Dev.)*
1. The AMT program prepared me well for the practice of aircraft maintenance related work	1.67 (0.52)
2. In comparison with my co-workers who graduated from other programs, I rate my education superior to their	2.33 (1.03)
3. My program prepared me well in the use of computers and computational techniques	3.50 (1.05)
4. My preparation in communication skills (written/oral) was excellent.	3.00 (0.89)
5. The overall quality of my department was excellent (compared with the rest of the college/University)	2.33 (1.51)
6. The departmental laboratory experience/projects prepared me well for the practice if my discipline	2.50 (1.64)
7. The overall departmental environment enhanced me education	1.67 (0.52)

* 1- strongly agree, 5- strongly disagree

Table 4.14 Alumni survey responses

Question	Response / Comments
8. Which of the following general categories best describes your current work assignment?	1. Maintenance 2. Continuing Education
9. What type of continuing education programs have you participated in?	3. Selected from courses 4. Non-credited short courses 5. Formal Graduate program
10. What do you consider to be the greatest strength of your Aircraft Maintenance and Technology program?	6. Hands-on project, experienced staff. 7. All courses are offered in one centralized location, not spread over a large campus. 8. Power plant inspection and repair power plant throttle rigging. 9. The teachers and their knowledge. 10. Hands on experience (but there wasn't enough of it). 11. The personnel performing the training.

11. What do you consider to be the greatest weakness of your Aircraft Maintenance and Technology program?	12. Some of the curriculum is outdated (wood, dope, fabric) Add more advanced technology (electronics, computers etc.) 13. Some courses are offered only once every two years. You must take every course when it is first offered or you will take 4 years to complete a 2-year program. 14. Avionics Maintenance 15. It was a new program, (at the time) not enough equipment. 16. Scheduling of classes for graduation completion
12. What one or two specific curriculum changes would you recommend? Why?	17. Add more electronics or avionics. Industry seems to be moving that direction. More and more advanced electronics are appearing on the aircraft of today! The technicians of today need to be very familiar with computers of same sort. 18. Let summer school be optional- see above, if you don't go to summer school it will take 4 years to finish. 19. More in-depth study of Avionics and electronic systems. 20. Higher elective courses, higher level English, math, etc. 21. More hands on work (especially on commercial aircraft) 22. Offer obsolete classes like wood, dope and fabric as extras or electives and incorporate more relative courses as required.
13. Please provide any additional comments/ suggestions concerning your department.	1. A technical / community college is supposed to serve students and employees in the local area; however, there are not enough local jobs for all the graduates. To get a good job, graduates must leave the area. Therefore tech is serving employees outside the local area. 2. More support is needed from the commercial sector in Greenville county. 3. The AMT program needs updated training aids such as aircraft and engines that are in service. These updated training aids would give the students the required experience to be hired by the airlines. It would also attract more in and out of state students. 4. Wish the class could count toward higher degree, very upsetting it was 5. worthless to build upon, i.e. Bachelors Degree

Analysis of the student evaluations clearly revealed that the revised courses showed a high level of integration with computers and advanced technology compared to the older courses (responses to Questions 17 and 18 of Tables 4.1 and 4.9). Although the revised course scored high on most issues (e.g., use of computers, out of class assignments, use of class time, instructor's teaching methods), the course did not score high on issues related to course organization and links with textbook material. Follow-up interviews with course instructors and subjective evaluation from students revealed the various shortcomings leading to the lack of organization. The major reasons for these are as follows (1) student's and instructor's limited familiarity with using the Webct software for instruction delivery, (2) non-availability of lecture material on Webct before a particular class, and (3) problems associated with Webct software access. The above mentioned problems were addressed in the revised courses, by making the following changes: (1) introductory course material on using the internet and specifically Webct, (2) better coordination between presentation of material, hands on projects and exams, (3) improved access to lecture material to students. These and other changes were implemented in the summer of 2001.

In addition to the above teaching evaluation, other indicators and sources of data were used to provide information outside the scope of the formal assessment, to be used primarily in assessing the quality and in seeking improvements in departmental processes, course content and delivery, facilities and student

services. These include anecdotal information, which may be used by the Chair or discussed by the faculty leading to actions for improvement.

4.3 Offering 3 Curriculum Assessment

Data obtained from the teaching evaluations for offering 3 are summarized in Tables 4.15, 4.16, 4.18, 4.19, 4.21 and 4.22. The data for each question was also analyzed using the Wilcoxon test (Tables 4.17, 4.20 and 4.23). Student evaluations completed for the revised offering of Ground Operations and Safety course is summarized in Tables 4.24.

Table 4.15 Teaching evaluation: Ground Operations and Safety – Section 1

Question #	Responses				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	12			1	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	9	4	0	0	0

Table 4.16 Student information: Ground Operations and Safety–Section 1 (cont'd)

Question #		
1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
Course could probably have been taught in lees time		People should be told more about the class up-front so they can decide
Highly motivated, caring, enthusiastic instructor. Plenty of hands on.	Unavailability of aircraft due to other classes.	Closer coordination between instructor/classes.
Instructor knows what to do and when as far as labs covered much material in a short amount of time with success. Enjoyed class.		
Shows enthusiasm for aircraft and maintenance.		Do not know
Everything was strong I understood everything well		

Lab Equipment	Too much time in between students turn to perform tasks	Have more instructors for lab times
	Too many breaks	Need more real/ practical experience
Instructor knowledgeable and easy to work with	Computer courses could use some fine-tuning. Could be presented better. A little more depth.	have the material in the computer go along with the book. Have more information.
Detail oriented	Course is too long	Shorten the hours required

Table 4.17 Student responses: Ground Operations and Safety –Section 1 (cont'd)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	3.77 (0.73)	(p<0.05)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.38 (0.65)	(p<0.05)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	3.92 (0.64)	(p<0.05)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	4.08 (0.49)	(p<0.05)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.31 (0.75)	(p<0.05)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.82)	(p<0.05)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.92 (0.64)	(p<0.05)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	3.85 (1.07)	(p<0.05)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.31 (0.48)	(p<0.05)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.31 (0.48)	(p<0.05)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	4.08 (0.76)	(p<0.05)
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.31 (0.48)	(p<0.05)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.41)	(p<0.05)
16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.69 (0.75)	(p<0.05)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.57)	(p<0.05)

Table 4.17 Student responses: Ground Operations and Safety –Section 1 (cont'd)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	3.85 (0.99)	($p<0.05$)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	4.46 (0.52)	($p<0.05$)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.23 (0.44)	($p<0.05$)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	4.15 (0.69)	($p<0.05$)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	4.15 (0.55)	($p<0.05$)

Question #	Responses	
9. The course required the use of computers.	Yes	No
	12	1

Table 4.18 Teaching evaluation: Aircraft Structures

Question #	Responses				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	14			1	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	5	6	4	0	0

Table 4.19 Student information: Aircraft Structures (Continued)

Question #		
1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
The instructor is patient, he knows how to teach. He uses the right material to teach.		
The instructor does a good job.	Need to spend more time in class	

Table 4.19 Student information: Aircraft Structures		
Question #		
1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
Enjoy working in lab, good equipment to work, I know new things, I learn more.	That something was hard to understand and teacher explain me but still being hard	To have more or to make class more fun and to find ways to find information.
Good course, it could help me get a good job in aircraft field , good teacher.	That something was hard to understand and teacher explain me but still being hard	More hands- on -work to air planes
The strength of the course was that our teacher motivated us to improve to go on.		
Good Teaching		
Positive, shows respect when respected, very good teacher		
Good Equipment and Instructor		More hands on learning
The course gives a good understanding at real world situations that could occur in		
Good at explaining things		
Helps me learn what the workplace will be like		
	The teacher smart remarks	Get a different teacher

Table 4.20 Student responses: Aircraft Structures (Continued)					
Question #	**Likert Scale**		**Compared Mean**	**Mean(S.D.)**	**Wilcoxon test**
	1	**5**			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	4.40 (0.63)	($p<0.05$)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.83)	($p<0.05$)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	4.07 (1.03)	($p<0.05$)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	4.40 (0.83)	($p<0.05$)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.53 (0.83)	($p<0.05$)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	4.73 (0.59)	($p<0.05$)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.33 (0.98)	($p<0.05$)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	4.47 (0.92)	($p<0.05$)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.33 (1.40)	($p<0.05$)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (1.10)	($p<0.05$)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	4.67 (0.62)	($p<0.05$)
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.13 (1.06)	($p<0.05$)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	4.14 (0.86)	($p<0.05$)

16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (1.20)	(p<0.05)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.80 (0.94)	(p<0.05)
18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	4.13 (1.06)	(p<0.05)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	4.27 (1.03)	(p<0.05)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.53 (0.83)	(p<0.05)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (1.25)	(p<0.05)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	4.29 (1.14)	(p<0.05)

Question #	**Responses**	
9. The course required the use of computers.	Yes	No
	14	1

Table 4.21 Teaching evaluation: Ground Operations and Safety – Section 2

Question #	**Responses**				
1. I am satisfied with my accomplishments in this course.	Yes			No	
	12			0	
2. I expect to receive the following grade on this course.	A	B	C	D	F
	6	5	1	0	0

Table 4.22 Student information: Ground Operations and Safety – Section 2 (Cont'd)		
Question #		
1. Please list the strengths of the course and/or instructor.	**2. Please list the strengths of the course and/or instructor.**	**3. Please provide suggestions to improve the course.**
Very helpful in safety side of the aircraft		
Very knowledge of the material	Computer website at Clemson never worked.	
More lab work Vs. Class Lecture	Satisfied	
Actually towing and hands on tech. Are effective.	Scales were broke and computers were useless	More hands on , working scales
I like the teacher		Need more equipment
Taxi the plane-instructor taught us to walk on water.		
		More time in actual ground handling. Perhaps break up into groups so that we do not stand around so much.

Table 4.23 Student responses: Ground Operations and Safety – Section 2 (Cont'd)

Question #	Likert Scale		Compared Mean	Mean(S.D.)	Wilcoxon test
	1	5			
1. The course was well organized and outlined.	Very Strongly Disagree	Very Strongly Agree	3	3.83 (0.58)	(p<0.05)
2. The syllabus was distributed and explained at the beginning of the course.	Very Strongly Disagree	Very Strongly Agree	3	4.42 (0.51)	(p<0.05)
3. The textbook and course material supports teaming.	Very Strongly Disagree	Very Strongly Agree	3	4.17 (0.39)	(p<0.05)
4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.	Very Strongly Disagree	Very Strongly Agree	3	4.17 (0.58)	(p<0.05)
5. The lab assignments supported my understanding of the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.25 (0.45)	(p<0.05)
6. The equipment and supplies are adequate for completing lab exercises.	Very Strongly Disagree	Very Strongly Agree	3	3.92 (0.67)	(p<0.05)
7. The course projects were challenging and helped me in understanding the course material.	Very Strongly Disagree	Very Strongly Agree	3	4.00 (0.60)	(p<0.05)
8. The course projects/lab assignments were based on real-world aircraft maintenance situations.	Very Strongly Disagree	Very Strongly Agree	3	4.17 (0.83)	(p<0.05)
11. The instructor treated students with respect	Very Strongly Disagree	Very Strongly Agree	3	4.33 (0.49)	(p<0.05)
12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.	Very Strongly Disagree	Very Strongly Agree	3	4.17 (0.72)	(p<0.05)
13. The instructor used the time effectively and efficiently.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.89)	(p<0.05)
14. The instructor's teaching methods helped me understand the course material.	Very Strongly Disagree	Very Strongly Agree	3	3.92 (0.79)	(p<0.05)
15. The instructor presentation material and class notes are of high quality.	Very Strongly Disagree	Very Strongly Agree	3	3.50 (0.80)	(p>0.05)
16. It is possible to easily access the presentation material during after-class hours.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.65)	(p<0.05)
17. The method of delivering instruction was highly effective.	Very Strongly Disagree	Very Strongly Agree	3	3.92 (0.67)	(p<0.05)

18. The instructor made adequate use of computers to support instruction.	Very Strongly Disagree	Very Strongly Agree	3	2.83 (1.19)	(p>0.05)
19. The instructor was enthusiastic about teaching.	Very Strongly Disagree	Very Strongly Agree	3	3.83 (0.72)	(p<0.05)
20. The instructor's expectations were made clear to me.	Very Strongly Disagree	Very Strongly Agree	3	4.08 (0.79)	(p<0.05)
21. The instructor motivated me.	Very Strongly Disagree	Very Strongly Agree	3	3.67 (0.98)	(p<0.05)
22. I will recommend this course to another student.	Very Strongly Disagree	Very Strongly Agree	3	4.33 (0.49)	(p<0.05)

Question #	**Responses**	
9. The course required the use of computers.	Yes	No
	12	0

10. If the answer to the above question is Yes, explain how computers were used in the course.	They contained the info about this course and were used for the majority of the lecture part of the class.
	ATP navigator program to use the maintenance manual. Powerpoint to present lectures. Internet Explorer to check MSDS.
	Powerpoint, ATP Navigator, C-172 CDT, Internet Explorer, C90
	The computers make the info we need as well as illustrated pictures available at any time, so assignments and class demonstrations can be finished quickly and easily.
	To look up important info.
	The computers were used to look up answers, show diagrams of airplanes, and help learn everything about the course.
	For lectures and ATP's.
	Look up text materials and maintenance info on specific aircraft.
	Used to present lecture materials and research.
	The whole course was on computer.
	For text and diagrams to learn on.
	Very helpful as a guide with pictures, presentations, as well as instructor guiding.
	The material on the slides of the computers was given on test and quizzes and also to reference maintenance manuals.
	Information for the course came from an online program called Powerpoint.

Analysis of the student evaluations clearly revealed that the revised courses showed a high level of integration with computers and advanced technology compared to the older courses (responses to Questions 17 and 18 of Tables 4.17, 21, and 4.23). Although the new revised course scored high on most issues (e.g., use of computers, out of class assignments, use of class time, instructor's teaching methods), the course did not score high on issues related to course organization and links with textbook material.

Follow-up interviews with course instructors and subjective evaluation from students revealed the various shortcomings leading to the lack of organization. The major reasons for these are as follows (1) student's and instructor's limited familiarity with using the Webct software for instruction delivery, (2) non-availability of lecture material on Webct before a particular class, and (3) problems associated with Webct software access. The above mentioned problems were addressed by implementing some of the changes that were recommended as part of offering 2 period.

In addition to the above teaching evaluation, other indicators and sources of data were used to provide information outside the scope of the formal assessment, to be used primarily in assessing the quality and in seeking improvements in departmental processes, course content and delivery, facilities and student services. These include anecdotal information, which may be used by the Chair or discussed by the faculty leading to actions for improvement.

5. CONCLUSIONS

The focus of this research was the implementation and assessment of the integrated AMT/AMT-T curriculum on aircraft maintenance technology learning, aircraft maintenance technology performance (the ability to meet performance objectives and demonstrate acceptable performance), and on-the-job performance as demanded by the aircraft maintenance industry and the FAA. The curriculum development and assessment methodology developed as part of Year 2 activities was used to develop the revised courses for Ground Handling and Services, Turbine Engine and Overhaul and the Structures course. Detailed evaluations were conducted on the old offerings and new offerings of the same courses. Results from these evaluations were used to make changes and modifications to be implemented in the next offering of the courses.

The assessment methodology developed in Year 1 and deployed in Years 2 and 3 has led to the evaluation of the relative merits/consequences of the integrated curriculum and an evaluation of the use of advanced technology and alternative learning strategies (e.g., classroom, multimedia based, etc.) in implementing the curriculum and enhancing the learning experience. The use of results obtained from the assessment formed the foundation for further enhancement of the training process for the integrated AMT/AMT-T curriculum.

Improvements in teaching and learning were achieved through networking in industry and professional organization affiliations and through the integration of programs with local high schools. The GTC program has in place an articulation agreement with a local high school career center by which students can earn advanced placement credit toward the GTC AMT program. In addition, the GTC AMT Department is actively involved in co-op/work study programs with LMAC, Stevens Aviation, AlliedSignal, and others where many of the current program students and graduates are now employed.

6. References

1. Airasian, P. (1997) *Classroom Assessment*. McGraw-Hill Companies, Inc.

2. Denova, C. (1979) *Test Construction for Training Evaluation. England*: Van Nostrand Reinhold Company.

3. FAA (1997) Aviation Maintenance Technician Training: AMT/AMT-T Curriculum (An alternative method of compliance with Federal Aviation Regulation Part 66) Technical Report prepared for the Office of Aviation Medicine (AAM-240) and Flight Standards Service under Contract #DTFA01-94-C-01013.

4. FAA (1995) Human Factors Issues in Aircraft Maintenance and Inspection'95 CDROM Published by Galaxy Scientific Corporation.

5. FAA (1993) Human Factors in Aviation Maintenance – Phase Three Volume 1 Progress Report. DOT/FAA/AM-93/15.

6. Gagne, R. M., Briggs, L., and Wager, W. (1992) *Principles of Instructional Design.* San Diego, CA: Harcourt Brace Jovanovich College Publishers.

7. Gramopadhye, A. K., Kraus, D., Rao, P. and Jebaraj, D. (1996) Application of Advanced Technology to Team Training. *Proceedings of the Human Factors and Ergonomics Society 40th Annual Meeting*, 1072-1074, Philadelphia, PA.

8. Gramopadhye, A. K., Drury, C. G., and Prabhu, P. V. (1997) Training Strategies for Visual Inspection. *Human Factors and Ergonomics in Manufacturing*, Vol. 7 (3), 171-196.

9. Gramopadhye, A. K., Melloy, B. Hector, H, Koenig, S, Nickles, L. Thaker, J., Kaufman, J. (1998) ASSIST: A computer-based training program for aircraft inspectors. *Human Factors and Ergonomics Society 42nd Annual Meeting*, Chicago.

10. Hopkins, C. and Antes, R. (1985) *Classroom Measurement and Evaluation. Illinois*: Peacock Publishers, Inc.

11. Hopkins, K., Stanley, J., and Hopkins B.R. (1990*) Educational and Psychological Measurement and Evaluation*. New Jersey: Prentice-Hall, Inc.

12. Kozma, R., Belle, L., and Williams, G. (1979) *Instructional Techniques in Higher Education*. New Jersey: Educational Technology Publications.

13. Lien, A. and Lien, H. (1980) *Measurement and Evaluation of Learning*. Iowa: Wm. C. Brown Company Publishers.

14. Lineman, R. (1967) *Educational Measurement*. Glenview, Illinois: Scott, Foresman, and Company.

15. Nichols, J. (1995) The Departmental Guide and Record Book for Student Outcomes Assessment and Institutional Effectiveness. Agathon Press. New York.

16. Seels, B. and Glasgow, Z. (1998) *Making Instructional Design Decisions*. New Jersey: Prentice-Hall, Inc.

17. Ward, A. and Murray-Ward, M. (1999) *Assessment in the Classroom*. Wadsworth Publishing Company.